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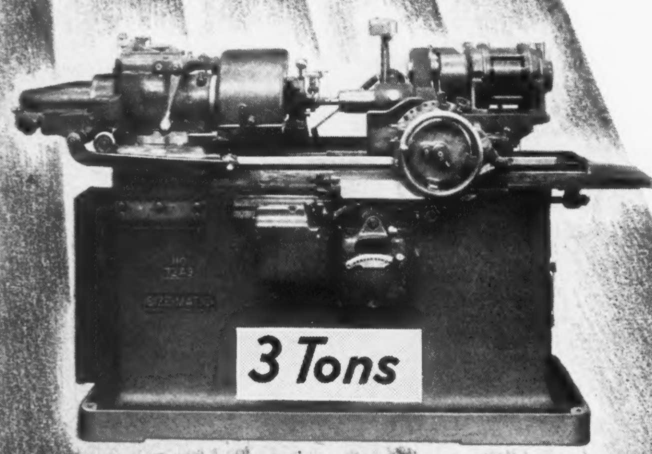

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The Heald Machine Company, Worcester, Massachusetts, U. S. A.

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MACHINERY

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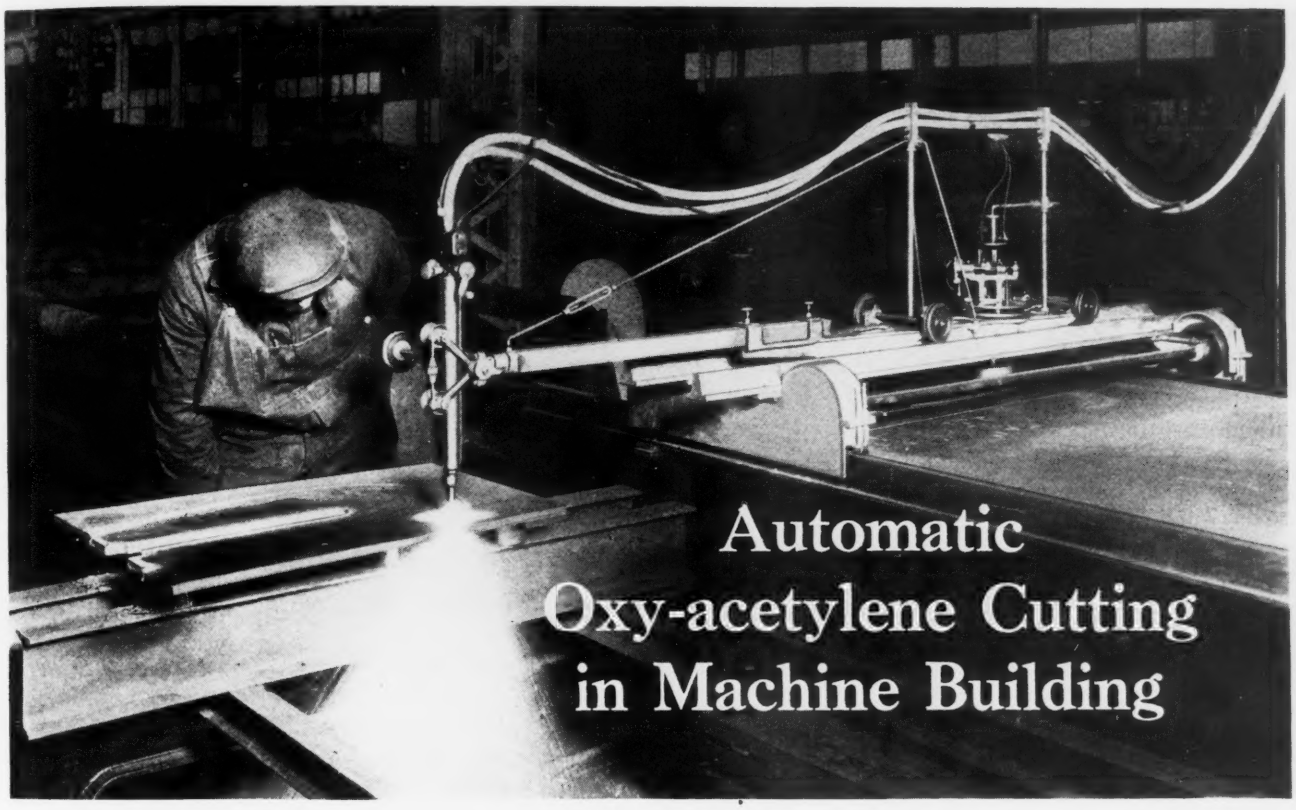


Automatic Oxy-acetylene Cutting in Machine Building

Application of Machines Having Automatically Guided Blowpipes which Cut Steel Billets and Plates to Shape in any Thickness up to Fifteen Inches

By D. E. ROBERTS,
The Linde Air Products Co.

AUTOMATIC oxy-acetylene cutting machines, such as shown in the heading illustration, have become an important part of the production equipment in many large plants in the machine-building industry. Billets, steel plates, and structural shapes are automatically cut to almost any desired form by these machines. In many cases, the pieces are cut so accurately that no further machining is required. Even when additional machining is necessary or desirable, the work can be cut so close to dimensions by the recently improved machines that only a very small amount of machining is required. These machines are of rugged construction and designed to have the precision of a machine tool. They have longitudinal and transverse movements, and are so designed that a pull of only a few ounces will cause the blowpipe to follow any desired cutting line.

Simple Templets Control the Shape of the Work

Metal templets which guide the cutting path of the torch are made from aluminum strips. These strips are easily bent to any desired shape and are riveted to a sheet-steel base. The templets are kept on hand so that any number of identical pieces can be made. After the operator starts the machine, the action is entirely automatic, right up to the completion of the cut.

These automatic shape-cutting machines are often used to decrease the amount of machining required on forgings or pieces cut from billets. In Fig. 1 a machine is shown taking a 16-inch cut on a heavy forging. These machines are also used extensively for cutting out parts for large machine frames from plate and structural steel shapes, as shown in Fig. 2. These cut-out members are then joined by welding.

For large-scale production, the cutting machines and welding outfits are generally installed as part of the regular production equipment, so that the complete fabrication of the product takes place in the manufacturer's plant.

Many concerns that have no shape-cutting equipment make a practice of having pieces cut to their specifications by steel fabricating shops. There are numerous shops of this type that are fully equipped to supply oxy-acetylene cut billets or steel plates in any desired shape. In such cases, the pieces are

delivered to the customer, who completes the machine frame by welding the different elements together.

Another practice is to have the machine base or frame built entirely by a contracting shop provided with cutting machines and welding equipment. Such shops are prepared to work to the blueprints supplied by their customers. The two latter methods are of particular interest to those who design special machinery or require a limited number of machines.

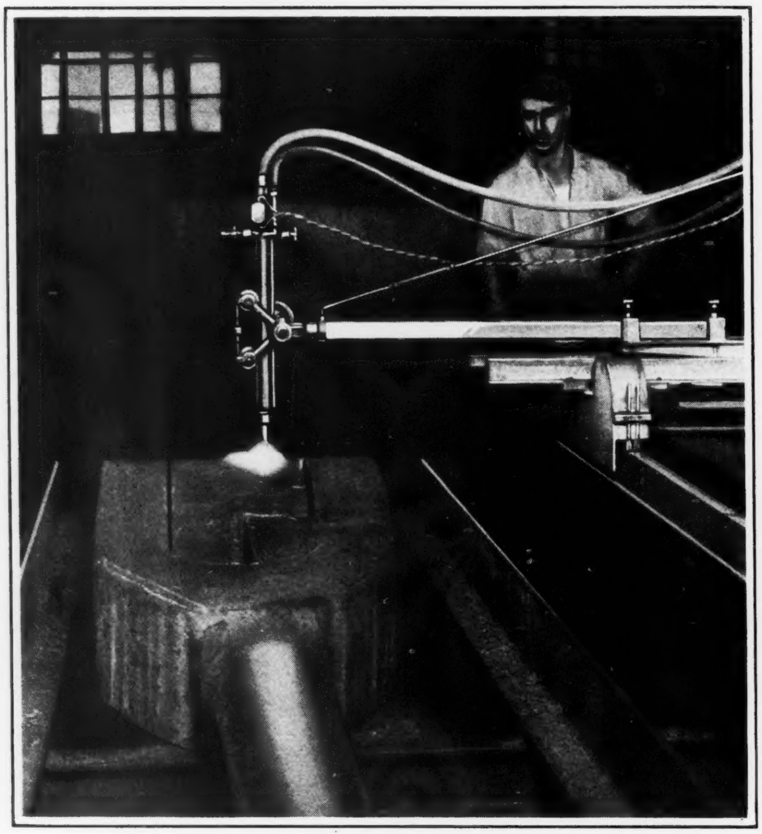


Fig. 1. Cutting a Steel Forging, Sixteen Inches Thick, with an Automatically Guided Oxy-acetylene Torch

A large manufacturer of power shears, forming presses, bending brakes, and other heavy machinery builds all machines with welded steel frames. Many of the moving parts of these machines are cut from rolled steel by the shape-cutting machine. In this particular plant, production has been more than doubled by keeping large quantities of heavy steel plate in stock, which can be cut to the desired shape for frames and other parts.

A power squaring shear of attractive appearance, made by this company, is shown in Fig. 4. It is estimated that, if the present production schedule were to be maintained in this plant without the use of the shape-cutting machine, a plant nearly three times as large as the present one would be required. The company is called upon from time to time to supply machines of unusual size that require special parts. By using the shape-cutting machine on steel plate, a complete machine can be fabricated and made ready for delivery in about forty-eight hours.

A large distributor of steel, with plants in different parts of the country, uses a duplex type of automatic oxy-acetylene cutting machine in his various plants. By means of this machine all kinds of irregular shapes in steel are supplied to the customers. The duplex type of machine has two cutting units, which may be used either independently or simultaneously, cutting either on the same or different pieces. This company supplies steel shapes in thicknesses up to 15

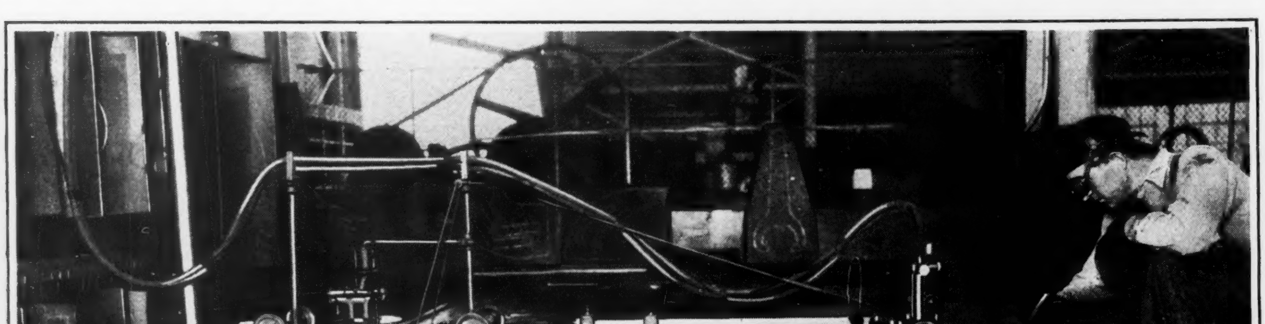


Fig. 2. Cutting Heavy Plate with Automatic Shape-cutting Machine

inches. In most cases, the parts thus supplied require no further machining, and all pieces made from the same templets are identical.

The shear frame illustrated in Fig. 5, which weighs 10 tons and measures 10 feet long by 11 feet high by 6 feet wide, and the winch shown in Fig. 6 were completely fabricated in a contract welding shop working from blueprints supplied by the customer. The pieces are cut from standard steel shapes with an automatic oxy-acetylene cutting machine and joined together by welding.

Other examples of the application of the cutting machine include the manufacture of power shovels by a concern that makes use of over 150 templets in the production of various parts, and the production of Diesel engines by a manufacturer who employs 450 templets. This particular manufacturer turns out ten tons of shape-cut steel each month for use in constructing engine parts. Still another company, which manufactures a varied line of heavy machinery, uses the automatic shape-cutting machine in producing parts for crawler and wheel type tractors.

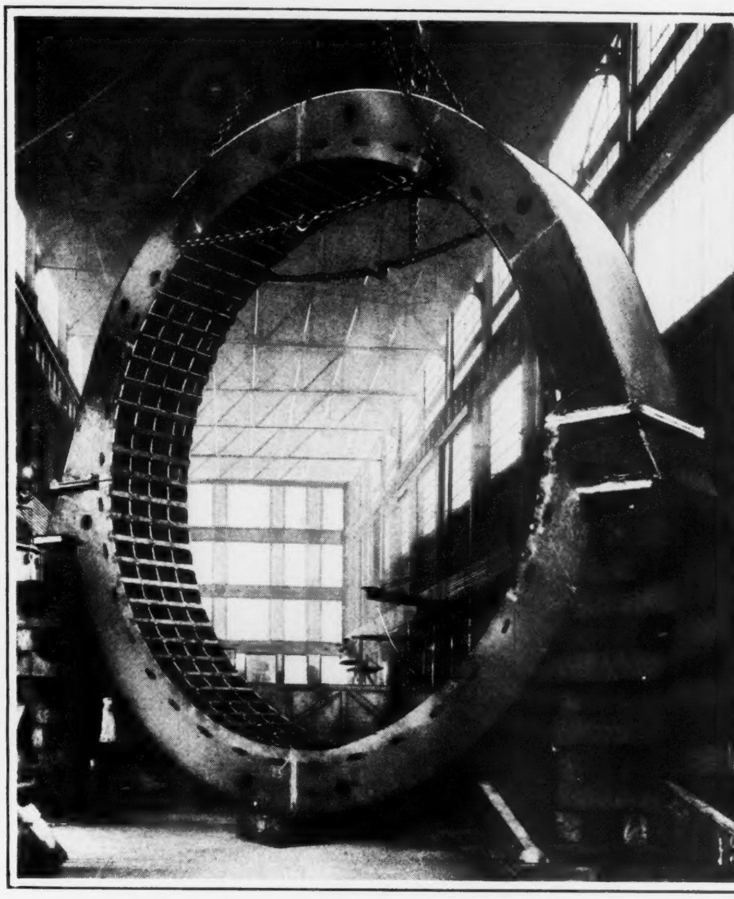


Fig. 3. Yoke for 25,000-KVA Generator Assembled by Welding Together Pieces of Plate Steel Cut to the Required Dimensions

Among other parts made in large numbers by this method are machine bases, yokes and rotors for electric generators and motors, transformer covers and tanks, drums and operating levers for hoists, guards for steam engines, parts for cement grinding mills and kilns, and plates for condensers.

Constructing a Steel Yoke for a 25,000-KVA Generator

Fig. 3 shows a welded steel-plate yoke for a 25,000-KVA water-wheel generator, the parts of which were cut out on the oxy-acetylene shape-cutting machine. This yoke, which was designed for a city on the Pacific coast, was originally intended to be shipped in two pieces, as evidenced by the bolted flanges on each side. At the time of

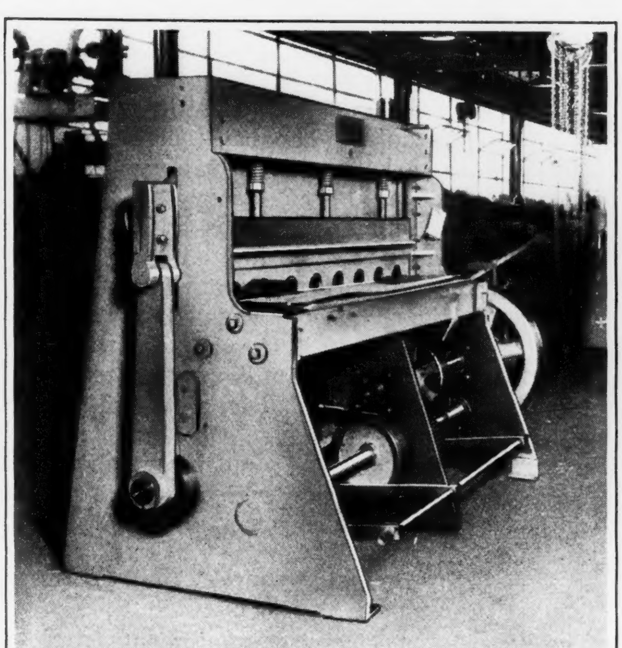


Fig. 4. Power Squaring Shear Fabricated from Parts Cut to Shape by Machine Shown in Heading Illustration

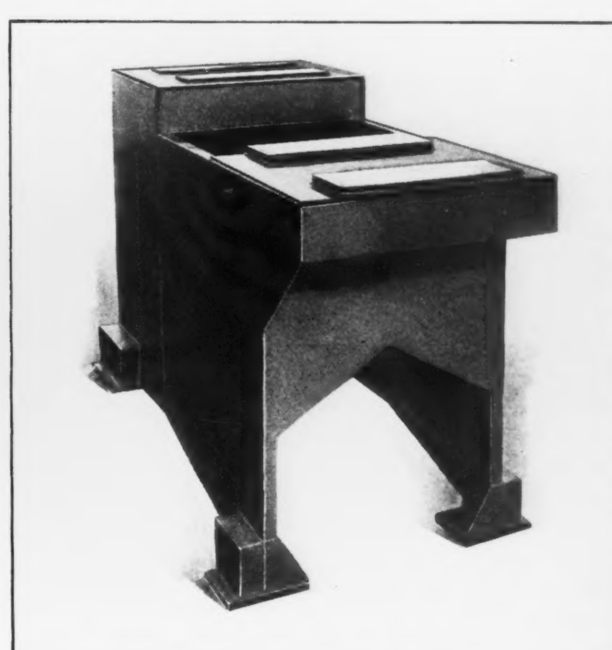


Fig. 5. Slab Shear Frame Weighing Ten Tons, Produced by Welding Together Parts Cut from Steel Plate

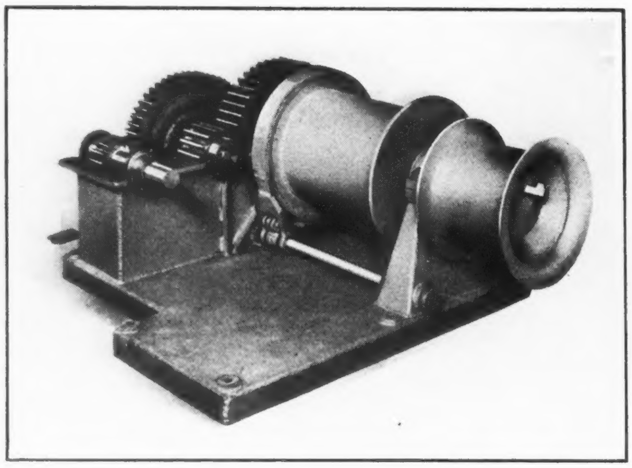


Fig. 6. Winch Constructed Principally of Parts Cut to Shape and Welded Together

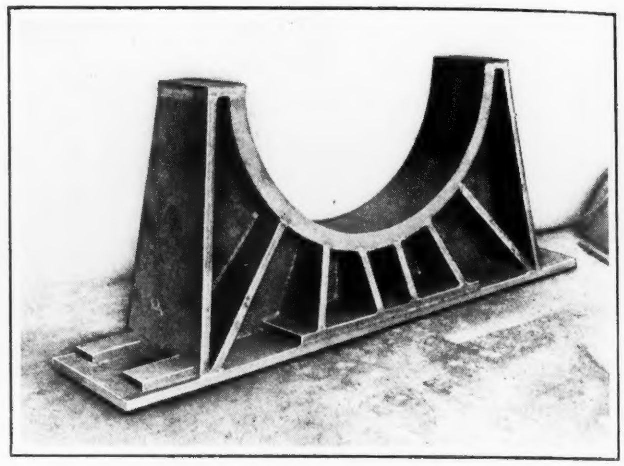


Fig. 7. Pedestal Type Bearing Base of Cut and Welded Steel Plate Construction

shipment, it was found that insufficient clearance at certain points on the only available route would prevent shipping the yoke in two parts. Oxy-acetylene cutting was therefore employed to cut the yoke at the top and bottom. Flanges were then provided at these points so that the yoke could be disassembled and reassembled in four pieces.

In Fig. 7 is shown a pedestal type bearing base for a large cement grinding mill manufactured by the same company. It is designed for a 30-inch bearing which carries a load of 225,000 pounds. The parts for this assembly were cut out on the automatic shape-cutting machine.

The low-carbon steels commonly used for fabricating machine parts are cut to shape without any heat-treatment before or after the cutting operation. It is recommended that steels having a carbon content higher than 0.25 per cent and most alloy steels be preheated before cutting and that they be normalized after the cutting operation. Users of the automatic shape-cutting machine are furnished with a chart showing the temperature to which the metal should be preheated and the correct normalizing temperature, according to the composition of the steel. The proper handling of the various grades of steel required for different machine parts is simplified by referring to these charts.

From the foregoing, it is evident that the use of the automatic shape-cutting machine speeds up production, lowers costs, and provides a valuable means of fabricating special equipment.

Economy in Handling Experimental Work

Bench designing and the adaptation of parts that could be bought in the market made possible a considerable saving in the cost of an experimental Diesel engine recently built. The engine would have cost a great deal more than it did if built by the methods usually followed. The inventor, C. C. Pittman, 111 West 17th St., New York City, performed all the machine work himself, working at odd times and using only rough sketches or diagrams which he made up quickly at the bench as the work progressed. Mr. Pittman, who has previously served as a skilled mechanic in the shops of two well-known producers of Diesel engines, and who is thoroughly familiar with modern drafting-room methods, believes that the drawings alone, of the kind generally considered necessary before undertaking to build an experimental engine of this kind, would have cost six or seven hundred dollars.

It is probable that what might be considered "skeleton lay-outs" could, in many cases, be made up advantageously in the drafting-room for experimental designs, especially where a skilled mechanic is to handle the shop work. Such drawings would give the principal dimensions and the more important designing data. The constructional details could then be worked out to advantage by the so-called "bench designing method."

Thus, the draftsman who has all the facilities for making drawings could lay out accurately and quickly the more important ideas, while the experienced man in the shop could work out the constructional details. The man in the shop has the advantage of being thoroughly familiar with the machines on which the work is to be done, and he also knows what materials are available. Of course, the man who handles this work must understand the fundamentals of machine design and be able to proportion the various parts so as to give the required strength.

* * *

The exports of electrical equipment from the United States for the seven months ending July 31, 1930, amounted to $81,218,625, or $1,810,812 less than for the corresponding period last year.

Selecting and Installing Air Compressors

Should a Single- or Two-stage Compressor be Purchased? What Mistakes Should be Guarded Against in Installing Compressor Equipment?

By H. L. KAUFFMAN

THE first points to be decided in the selection of an air compressor are whether it should be of single-stage or two-stage construction and whether it should be air- or water-cooled. The answers to these questions depend mainly on the pressure and volume requirements and the kind of service that the compressor is expected to render. When a pressure under 150 pounds per square inch is sufficient, a single-stage compressor is generally recommended, and for higher pressures, a two-stage compressor should be employed. Very often, however, a two-stage compressor is preferable under any condition, due to the fact that with this type, the heat of the discharged air is not so high as with a single-stage compressor; consequently the fire hazard and possibility of tank explosion, due to high temperatures igniting the oil vapors, are reduced.

In this article, the author stresses the point that low first cost alone should not influence the prospective purchaser of an air compressor. He should also consider the cost per cubic foot of free air compressed and delivered by the compressor and the maintenance and operation costs. A higher priced compressor will often prove a better investment if it insures not only a larger volume of air delivered, but also a higher efficiency and better performance, with fewer delays or shutdowns and less cost for repairs. Briefly, there is no difference between the principles to be applied in buying air compressors and those that govern the purchase of other equipment.

Differences between Single- and Two-stage Compressors

In a single-stage air compressor, the air is compressed to the final pressure at one stroke of the piston. There may be one, two, or more cylinders, each cylinder pumping alternately. In a two-stage compressor, there are two cylinders. In the first, or low-pressure cylinder, which is the larger of the two, the air is compressed to approximately 40 or 50 pounds per square inch, and it is then passed through an intercooler to the high-pressure cylinder. This cylinder compresses the air to the final pressure.

From the foregoing it will be apparent that because a compressor has two cylinders it is not necessarily a two-stage compressor. In a two-stage equipment, the air flows through both cylinders in series—that is, first through one, and then through the other—while in a two-cylinder single-stage compressor, the air is pumped independently by each cylinder into the storage tank.

How the Capacity of Two-stage Compressors is Determined

The capacity of a two-stage compressor is that of the low-pressure cylinder alone, since air is taken into that cylinder only. Consequently, to figure the capacity of a two-stage compressor, the cubical contents of the low-pressure cylinder are multiplied by the number of strokes per minute. The result is the cubical displacement per minute.

For example, if the low-pressure cylinder of a compressor has a diameter of 3 inches, a piston stroke of 3 inches, and a speed of 200 revolutions per minute, the area of the piston equals 7.068 square inches, and the displacement equals $7.068 \times 200 \times 3 = 4240.8$ cubic inches, or 2.4 cubic feet.

Functions of the Intercooler

The primary purpose of the intercooler is to remove the heat of compression, but it also removes moisture. A two-stage compressor provided with an intercooler requires less power than a single-stage compressor of the same capacity. This is because, in a single-stage equipment, where the air is compressed at one stroke of the piston, there is no means of removing the heat during compression. The power saving effected by a two-stage compressor over one of the single-stage type is in direct proportion to the amount of heat that can be removed by the intercooler, and, therefore, depends on the efficiency of the intercooler.

Thus, the objects of intercooling are fourfold: Reduction of required power, removal of moisture, low air temperature at the inlet to the high-pressure cylinder, and low discharge temperature. As regards the power consumed, starting with perfect intercooling, every increase of 10 degrees in the temperature of the inlet air to the high-pressure cylinder above the temperature of the low-pressure inlet air results in increasing the horsepower required for operating the compressor almost exactly 1 per cent.

Moisture held in suspension in the atmosphere taken into the low-pressure cylinder will remain suspended after compression in the first stage, because the increase in temperature due to compression more than offsets the effort exerted to deposit the moisture. By cooling the air which has already been compressed to atmospheric temperature, the moisture entrained is condensed and may be drained from the intercooler. The removal of the moisture is, of course, especially important in the winter when there is danger of the air lines becoming frozen.

A water-cooled air compressor is generally recommended by the author for operating air drills, air hammers, blow-pipe nozzles at lathes, drilling machines, and benches, pneumatic valve grinders, pneumatic hoists for lifting engines and the like, small sand-blasting equipment, paint sprays, pneumatic rubbing tools, etc.

Important Points Concerning Intercooler Construction

Since the efficiency of a two-stage compressor depends largely upon the efficiency of its intercooler, careful thought should be given to the material of which the intercooler is made, the thickness of that material, and how well the radiating fins are attached to the intercooler pipe. The intercooler should not be of heavy, rigid cast-iron construction with the idea of serving as a brace to prevent damage in shipping, or as a handle for moving the compressor about, or as a substitute for proper crating.

Intercoolers made of copper usually prove most satisfactory, owing to the fact that, with the exception of gold and silver, this metal has the greatest heat conductivity. Copper will conduct heat 135 per cent faster than cast iron, 112 per cent faster than steel, and 22 per cent faster than aluminum. Incidentally, aluminum is not a satisfactory metal for intercooler purposes because of its porous nature and because it cannot be made air-tight without treating it in such a way as to further reduce its heat-conducting qualities. In the opinion of the writer, devices made of cast iron or of pipe with cast-iron or steel washers slipped over the pipe are the least efficient types of intercoolers.

Air storage tanks should be installed in a cool place; care should be taken to see that the tank is safe for the working pressure to which it is subjected, and that it is properly fitted for draining off moisture at regular intervals. It is not advisable to use tanks for the storage of compressed air that are built for other purposes. All outside piping should be laid underground, below the freezing zone, and should have as few bends and pockets as possible. If feasible, the piping should slope to a drainage point, where moisture can be drained off at least once a week. In many cases, it is advisable to drain the moisture from the tank and the piping daily.

Mechanical, Volumetric, and Compression Efficiency

In any compressor, high mechanical efficiency depends upon accurate alignment; adequate lubrication of all bearings; proper design of bearings so that pressures are relatively moderate; proper design of valves for low clearance, for free passage and low velocity of air, and for elimination of friction as far as possible; elimination of all possible mechanically operated valves and parts, tension springs, and inertia; and good workmanship throughout.

Volumetric efficiency is the ratio between the amount of air theoretically possible for the compressor to deliver and the amount actually delivered. There are six reasons for loss in actual air capacity, namely: Heating of the surface in the cylinder because of a high ratio of compression; slight heating of the air being taken in; wire drawing of the air on the intake due to a restricted inlet opening or an imperfect unloading system; leakage of valves, piston-rings, etc.; re-expansion of air in the clearance spaces; and restricted valve areas.

A high volumetric efficiency depends upon the admission to the air cylinder of the maximum volume of free air as cool and dense as possible or, in other words, at atmospheric temperature; and the compression and delivery through the discharge valves of as much of this entire volume as possible.

Compression efficiency in an air compressor may be defined as the ratio of the power theoretically required to produce a given pressure in a given volume of air to the power actually required. It is a question of getting the air into the cylinder with the least amount of work, cooling it properly during compression, and then passing the air out of the cylinder and into the receiver with the least amount of work.

Low first cost alone should not govern the selection of an air compressor. The prospective purchaser should also consider the cost per cubic foot of free air compressed and delivered by the compressor, and the maintenance and operation costs. The first cost alone is not a true basis for comparison if the higher priced compressor not only insures a larger volume of net air delivered, but also, by superior construction, will maintain its higher efficiency and performance with fewer delays and shutdowns and less cost for repairs. Under such conditions, the higher priced compressor will prove the better investment.

Satisfactory Compressor Service Depends upon Proper Installation

Compressors should be installed in easily accessible places and, for most satisfactory service, should not be located in cold, dusty or damp rooms or basements. On the other hand, the air-storage tank should be installed in a cool place, out of doors, for example, so that any moisture in the air will be precipitated, and can be drained off, thus being prevented from working its way into the pipe lines.

Cheap, improperly constructed air tanks, range boilers, or tanks built for other purposes than for the storage of compressed air should not be used. Care should be taken to see that the tank is safe for the working pressure to which it is to be subjected, and that it is properly fitted for draining off moisture at regular intervals. The air receiver should be provided with a safety or relief valve, and when the receiver is out of doors, this relief valve should be piped back into the compressor room to prevent freezing. A valve should never be placed between the compressor and the receiver unless the latter is protected by a safety valve on

the side nearest to the compressor; otherwise the results may be disastrous.

All outside piping should be laid underground below the freezing zone, with a minimum of bends and pockets. When possible, the piping should slope to a drainage point and drain cocks should be provided. Such points, as well as the air-storage tank, should be drained at least once a week, and daily drainage is often advisable. To operate an air compressor at its maximum efficiency, it is important to follow the manufacturer's recommendations closely.

Increased Power and Productivity of Machine Tools

"Machine Tool Milestones, Past and Future" was the subject of a paper read by S. Einstein, chief engineer of the Cincinnati Milling Machine Co., before the French Lick meeting of the American Society of Mechanical Engineers, October 13 to 15. In this paper, Mr. Einstein reviewed the development of machine tools from their early beginnings. He especially called attention to the increase in power and productivity of these machines during the last twenty-five or thirty years.

Referring to the weight and power of machine tools since 1900, he used a No. 4 Cincinnati knee and column type of milling machine as an example. This type was selected simply because accurate data was easily available, but, in general, said Mr. Einstein, any type of machine tool would furnish similar facts. In 1900, the type of machine used as an example weighed 4450 pounds, and approximately 3 horsepower was sufficient to drive it. In 1905, the weight was increased to 5370 pounds, and the power to 5 horsepower. In 1907, this machine was redesigned and had a weight of 6800 pounds, with a 10-horsepower rating. In 1920, it weighed 8900 pounds, with a 15-horsepower rating; and in 1924, 9200 pounds, with the same power rating.

Increase in Cutting Capacity

To illustrate the advance in cutting capacity of machines and cutting tools, Mr. Einstein used as an example the amount of metal removed in cubic inches per horsepower per minute by a spiral milling cutter milling steel of approximately 55,000 pounds tensile strength. In 1907, it was considered good practice for a milling machine to remove 1/2 cubic inch per horsepower with a cutter made from high-speed steel. In 1913, the so-called "wide-spaced" cutters introduced about that time removed 3/4 cubic inch per horsepower per minute. In 1918, this was increased to 0.9; in 1924, to 1 1/4; and in 1928, to 1 1/2 cubic inches per horsepower per minute.

Increased Productivity of Machine Tools

To illustrate the growth of productivity in machine tools, the author made a comparison of the methods of splitting and straddle-milling connecting-rods from 1910 to 1930. In 1910, with four pieces held in a special fixture on the machine table, the production was 40 connecting-rods per hour; in 1920, with six pieces held in a removable work-holding fixture, so that one fixture could be loaded while the other was in the machine, the production had been increased to 90 per hour; in 1926, 110 pieces per hour were milled in a hand-indexing fixture; and in 1930, 248 pieces per hour are milled in an automatic indexing fixture.

In the grinding of valve tappets, the following figures for production per hour were given: In 1920, 90 pieces; in 1923, 150; in 1925, 300; in 1927, 450; and in 1929, 1350. In the last instance, three machines were operated by one man, so that the production per man was increased still further, as compared with the production per machine.

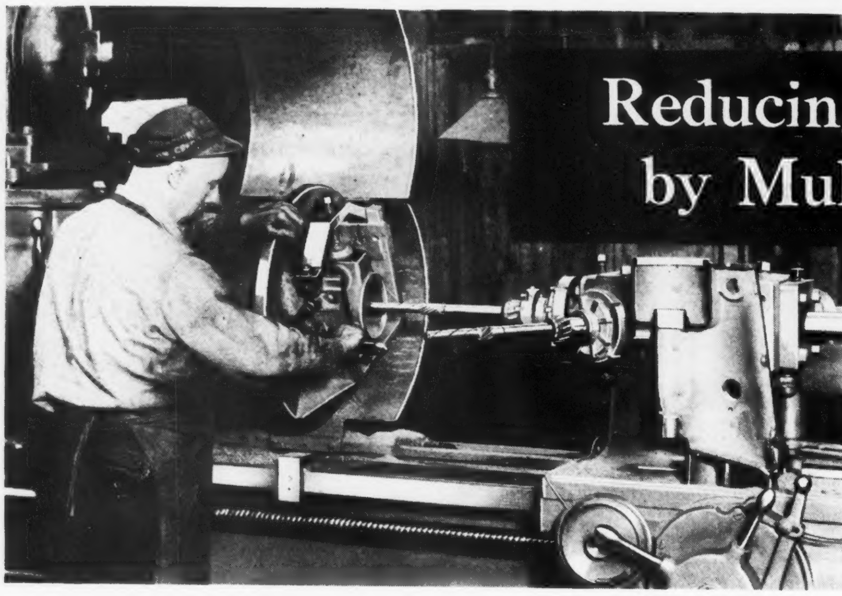
Future Developments in Machine Tool Design

As to future developments, the author said that it was reasonable to assume that machine tools will be heavier, more rigid, and more powerful. With the trend toward higher cutting speeds of tools, and the desire for machines to operate more smoothly and quietly, will come a development either to improve the existing gear transmissions or substitute some other means for them. This development might be toward frictional, hydraulic, or electrical mechanisms. The control of the machine will be further refined in the direction of ease and simplification of operation.

In the years gone by, many methods of shaping parts have been replaced by new ones. The file was replaced by the planer; the grinding machine replaced the lathe for finishing operations; milling machines took work from the planer and shaper, and so on. In some industries, the welded steel frame has replaced the cast structure. It is safe to assume that these developments will gain in popularity, and that certain machining operations will be replaced by welding. These changes will go on, and the future will find some of the present-day operations performed by new methods and on new types of machines.

* * *

After all, education should not be a process of cramming the mind full of knowledge, but rather of training the mind to know how and where to obtain information and how to use it when obtained. I believe this to be fundamental in technical and engineering education, and with my students I stress the need of obtaining good handbooks and reference works and studying them diligently with a view to learning what information they contain and how to apply it.—*John Homewood*



Reducing Operations by Multiple Tools

The Simultaneous Use of Several Tools Grouped on One Spindle Cuts Down the Number of Operations and Insures Concentricity of Circular Surfaces

WHEN a number of annular surfaces must be machined on parts of small or medium size, the job can often be simplified by using several tools on each machine spindle. This practice not only enables the number of operations to be reduced, but also facilitates machining the various surfaces within close limits of concentricity. Various applications of multiple tools will be described in two articles, of which this is the first. In these articles, the surfaces machined are designated by small letters, and the tools used by capital letters. All the tools described were designed and made by the Gairing Tool Co., Detroit, Mich.

Boring, Reaming, and Facing Pump Bowls

Tools designed for machining pump bowls of the type shown in Fig. 1 are illustrated in Figs. 2, 3, and 4. These bowls are iron castings made in many different sizes. Interchangeable cutter-heads are used to suit the different sizes. All operations on these parts are performed on turret lathes.

The first operation consists of rough-machining hole *a*, Fig. 1, with the spiral-fluted core-drill *A*, Fig. 2. This tool is guided below the work by pilot *B* which engages a bushing in the work-holding fixture. In the second operation, which is performed by means of the twelve-fluted spiral reamer *C*, the central hole *a* of the casting is finish-reamed. Reamer *C* is nose-driven by a full-floating holder which enables the tool to follow the rough-machined hole as guided by pilot *D*.

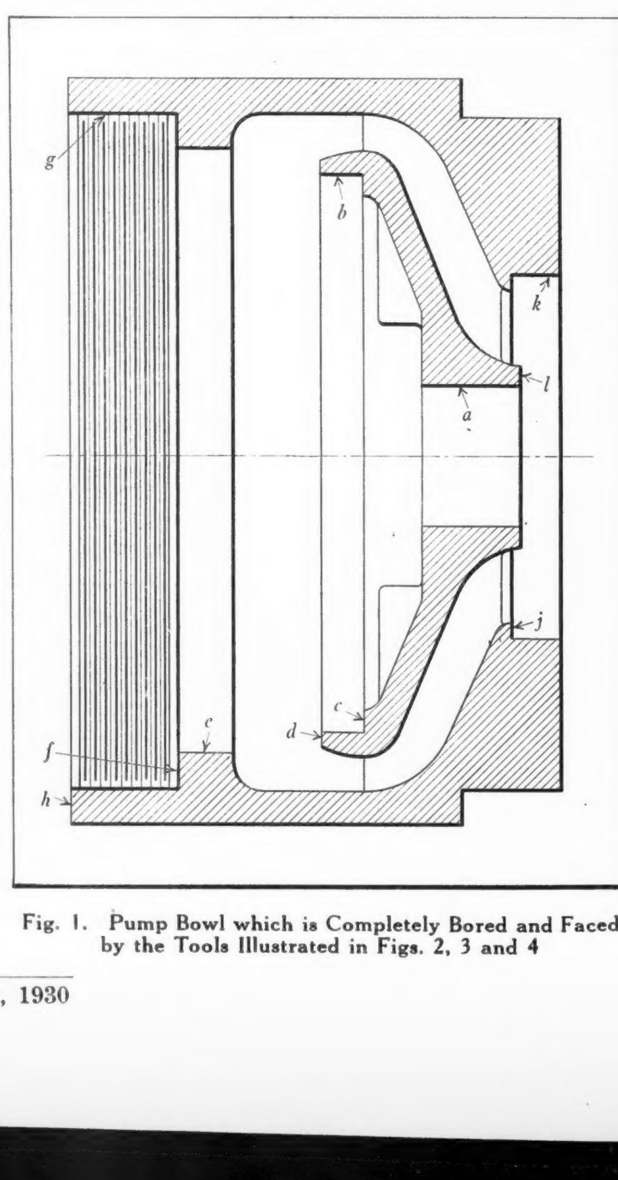


Fig. 1. Pump Bowl which is Completely Bored and Faced by the Tools Illustrated in Figs. 2, 3 and 4

Multiple Tools Used in Third and Fourth Operations

Fig. 4 illustrates the third and fourth operations, in which multiple tools are used for machining several surfaces simultaneously. For these operations, the work is turned end for end, as compared with the position in which it was held during the preceding cuts. In the third operation, roughing cuts are taken on surfaces *b* and *c*, Fig. 1, by inserted blades *E*, Fig. 4; lip *d* is faced and hole *e* bored by blades *F;* surfaces *f* and *g* are counterbored by blades *G;* and rim *h* is faced by blades *H*.

In the fourth operation, surfaces *b* and *c* are finished by inserted blades *K* of the tool assembly illustrated at the bottom of Fig. 4; and hole *e* is finish-bored by blades *L* of the same cutter assembly. There are twelve inserted blades in both of these cutter series. This cutter-head is guided by roller pilot *M* entering hole *a*, Fig. 1, which insures that the surfaces machined will be concentric with hole *a*.

Final Operations on Pump Bowls

For the fifth and sixth operations, the work is

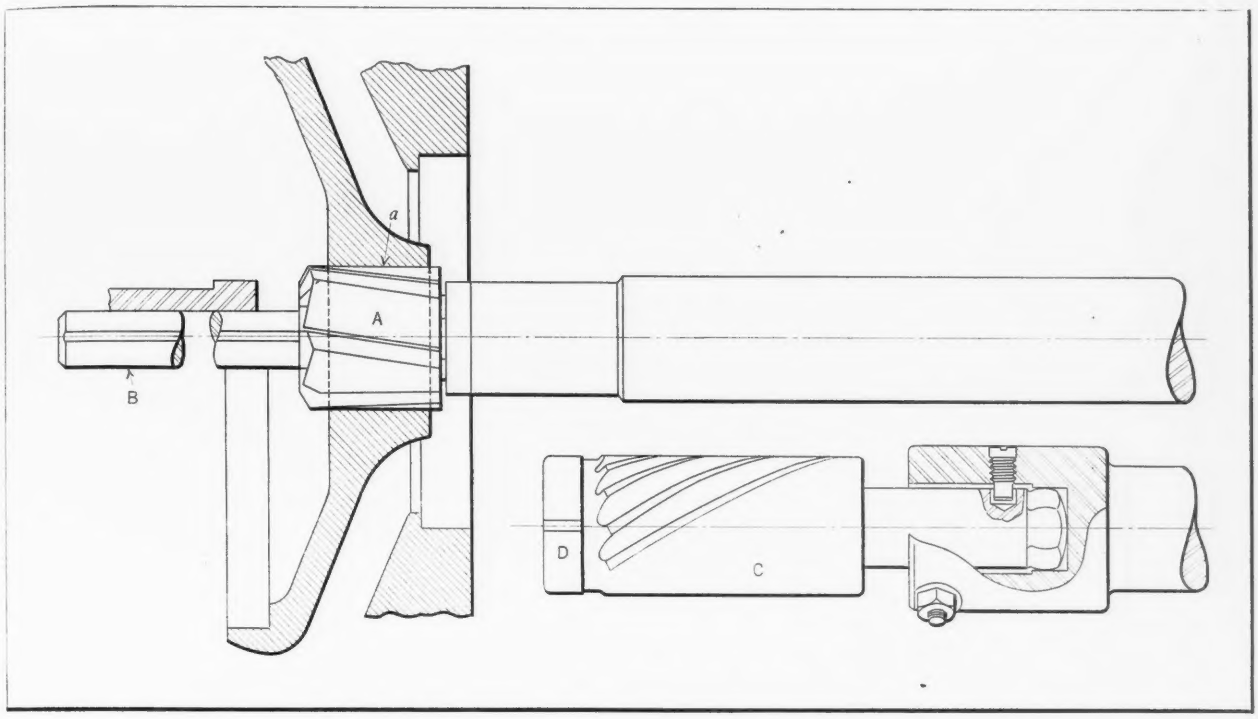


Fig. 2. Tools Employed for Boring and Reaming Hole a, Fig. 1, of the Pump Bowl

again turned end for end in order to machine surfaces *j*, *k*, and *l*. All these surfaces are rough-machined by inserted blades assembled on head *N*, Fig. 3, there being four blades for the counter-boring cuts and a similar number for the facing cut. Surfaces *j* and *k* are finished by the cutter-head *O* (shown at the bottom of the illustration), which is provided with eight blades. Both cutter-heads are guided by roller pilots which engage hole *a* in the work. With this arrangement, all other finished circular surfaces on the part are bored concentric with hole *a*.

The various surfaces of these pump bowls now machined in the manner described were previously finished in an engine lathe with single-point tools.

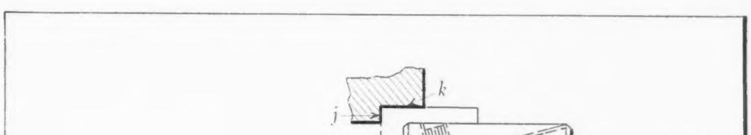


Fig. 3. Tools Provided for Finishing Surfaces j, k, and l of the Pump Bowl Casting

Tools Designed for Finishing Axle Drive-pinion Carriers

Fig. 6 shows an iron casting employed on an automobile for carrying the axle drive-pinions. Multiple tools are used for taking various boring, reaming, and facing cuts on this part. The first operation is performed with the tool assembly illustrated in Fig. 5. It consists of taking three successive cuts on the bores *a*, Fig. 6, facing the flange *b*, and chamfering the corner *c*.

The boring cuts are taken by three series of inserted blades *A*, *B*, and *C*, Fig. 5. Blades *A* are four in number and are held in a block that is mounted on the main boring-bar. These blades remove the scale in the bores. Blades *B* and *C* are contained in one holder, and there are six blades in each of these series. Blades *A* bore to a diameter of 3.206 inches; blades *B* to a diameter of 3.224 inches; and blades *C* to a diameter of 3.238 inches. Flange *b*, Fig. 6, is faced by inserted blades mounted on head *D*, Fig. 5, which simultaneously chamfer corner *c*.

Accuracy of these cuts is insured by providing pilots *E*

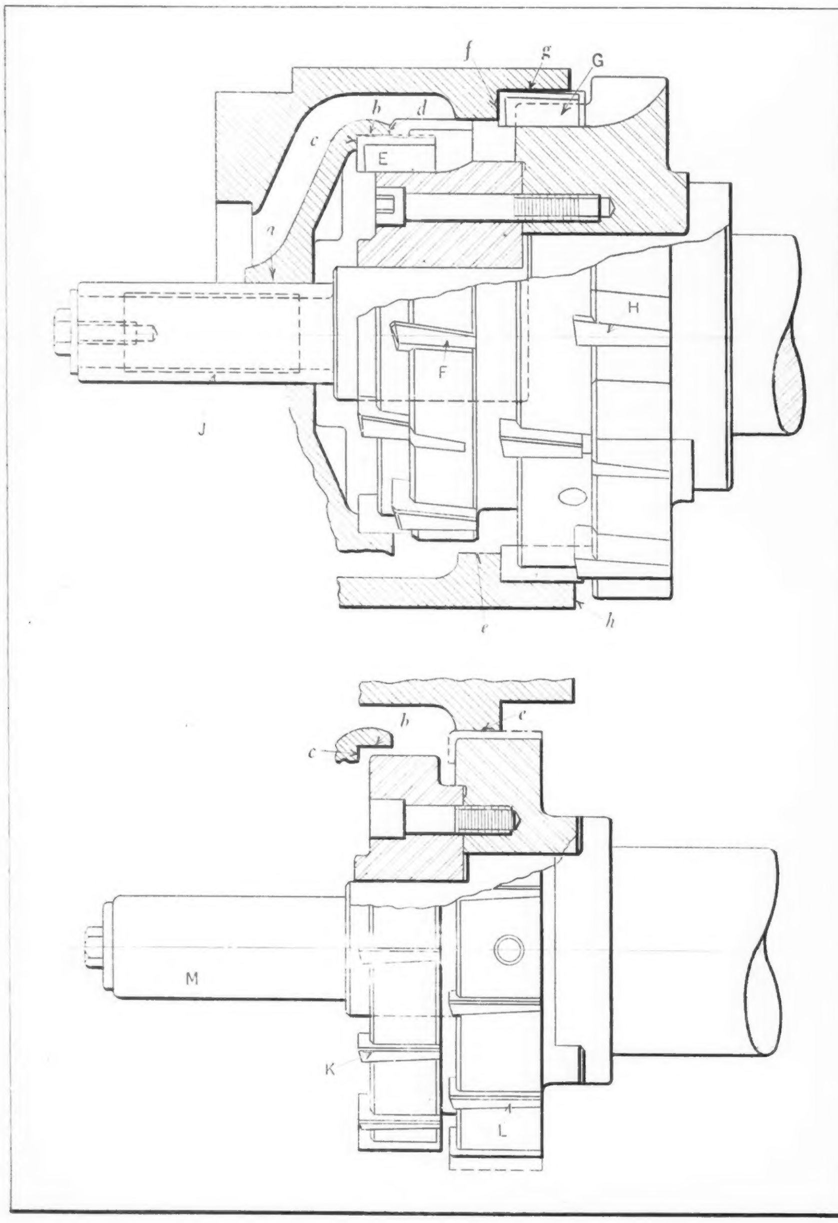


Fig. 4. Multiple Tool Assemblies Used for Finishing the Larger Internal Surfaces of the Pump Bowl Shown in Fig. 1, Concentric with Hole a

and *F* for guiding the tools, pilot *E* entering a bushing in the work-holding fixture, and pilot *F* a bushing in the head in which the tool assembly is mounted. Pilot *E* is of such a length that it never leaves its bushing. Pilot *F* is 4 7/8 inches in diameter, this large size being required on account of the fact that cutter-head *D* must withdraw into the bushing engaged by this pilot. A full-floating holder is used with this tool equipment. One man, running two machines, obtains a production of 450 castings per nine-hour day on this roughing operation.

Holes *a*, Fig. 6, are semi-finish-reamed with the multiple tool assembly illustrated in Fig. 7. This tool assembly is drawn through the holes by the nose, in order to apply the power as close as possible to the cutting points. Inserted blades *H* ream to a diameter of 3.238 inches, and blades *J* to a diameter of 3.250 inches. The blades are guided by pilot *G*, which, obviously, engages the holes to be reamed. In this semi-finishing operation, one man, running one machine, handles 600 parts per nine-hour day. Upright drilling machines are employed for both the roughing and semi-finishing operations.

A finish-reaming operation is later performed on holes *a*, Fig. 6; also flange *d* is faced by a tool equipped with a roller pilot that engages holes *a*. This operation accurately finishes the part to length.

* * *

The progress made in the use of X-ray equipment for detecting flaws in large castings and welds is indicated by the fact that radiographs have been taken through steel plate 4 inches thick in a lead-sheathed room at the University of Michigan. The ray for taking this radiograph was furnished by a tube of German manufacture operated at 230,000 volts.

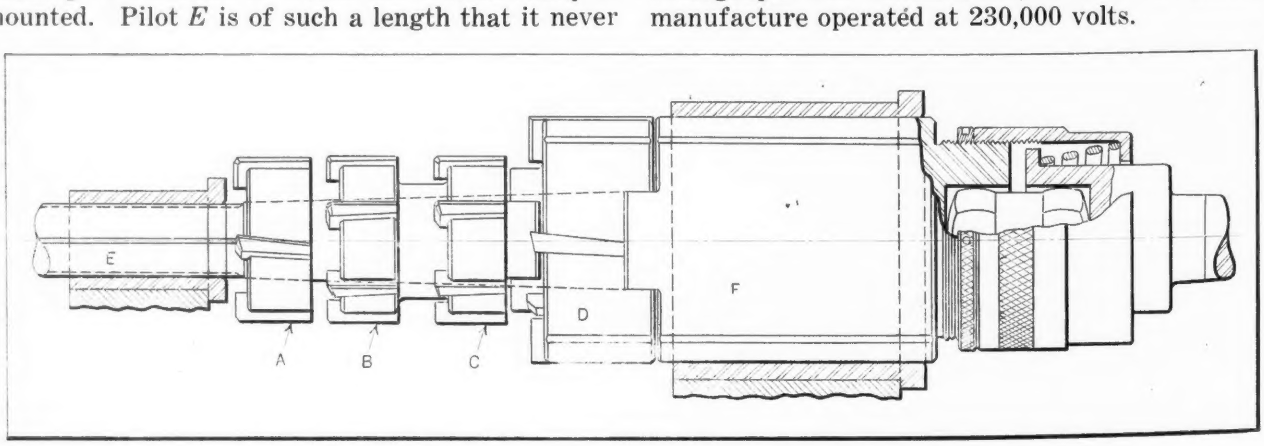


Fig. 5. Tool Assembly which Takes Three Successive Boring Cuts on Holes a, Fig. 6, Faces End b, and Chamfers Corner c

INDICATING FINISH ON DRAWINGS

By JAMES M. McINTOSH

Some comments on the article on indicating finish on drawings, on page 798 in June MACHINERY, may be of interest. It is all very well to indicate the kind of finish required; but it is also of value to show on a pattern drawing the amount that should be allowed for finish. If limits are given in connection with dimensions on drawings to show the degree of accuracy required in the machining department, why should not similar limits be placed on pattern drawings? In the writer's experience, a system of indicating limits by the symbols F1, F2, F3, etc., has been used, these symbols indicating that an allowance on the pattern of 1/32, 2/32, 3/32 inch, etc., should be made.

The amount of stock to allow on a casting is a problem that is not easy to decide, because of the shrinkage that takes place. On a casting where the depth may be only one-third the length, it might be thought that to specify an allowance of 1/1 inch on the depth and 3/16 inch on the over-all length would be correct. This, however, may not always work out, because the casting is likely to warp in cooling, so that a greater allowance is necessary on the depth than might be expected.

A good rule to prevent too much allowance on castings is to weigh the first sample casting carefully, and then cut it into sections to see that there is no surplus metal or core sand adding to the weight; then this rough casting weight should be noted on the drawing and a limit placed on the weight of castings to be made in the future. This would prevent castings with too much surplus metal from being made and would reduce the cost.

* * *

HOW THE DIE-SETTER CAN AID IN SAFE PRESS OPERATION

In a paper read before the nineteenth annual Safety Congress in Pittsburgh, Pa., George Miller, supervisor of tools in the metal-stamping department of the Westinghouse Electric & Mfg. Co., pointed out that the die-setter is the logical man to instruct the power press operators in the safe operation of presses. The die-setter is closer to the worker than any other supervisor, and his instructions are more likely to be followed conscientiously. The die-setter should consider it his duty to instruct new workers in the safe use of the machines and tools with which they work. He should warn the operator of the hazards peculiar to the power press, and should teach him to keep his hands outside of the danger zone. He should explain the purpose and use of safety appliances.

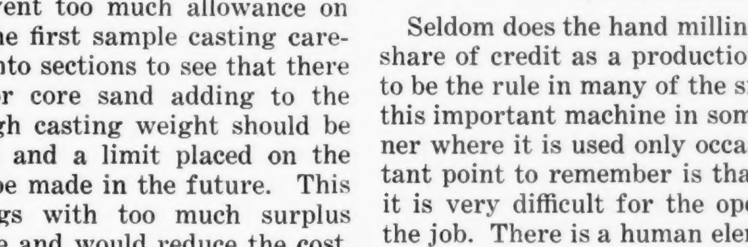


Fig. 7. Tool Assembly Used for Semi-finish-reaming Bores a of the Axle Drive-pinion Carrier

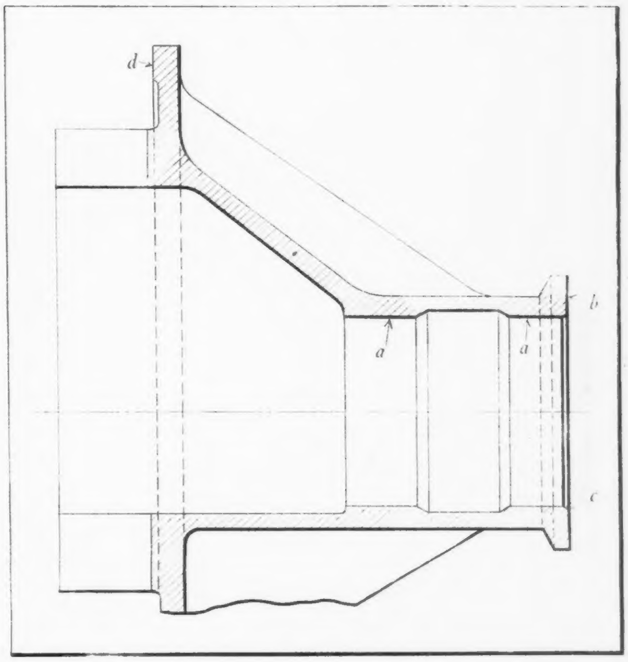


Fig. 6. Axle Drive-pinion Carrier Bored, Faced, and Reamed by the Tools Shown in Figs. 5 and 7

GIVING DUE CREDIT TO THE HAND MILLER

By ARTHUR MUMPER

Seldom does the hand milling machine get its full share of credit as a production machine. It seems to be the rule in many of the smaller shops to locate this important machine in some out-of-the-way corner where it is used only occasionally. One important point to remember is that, with this machine, it is very difficult for the operator to lie down on the job. There is a human element entering into its operation that is rarely considered—that is, the tendency on the part of the operator to push it to the limit. On a machine with a geared feed, the operator has a natural leaning toward the lighter feeds, especially when he has a fairly long surface to machine, which is a strong argument for the hand-feed machine on parts within its range.

An example familiar to every shop man is the drill press with the hand-feed lever. The majority of men use the hand-lever in preference to the geared feed, and by doing so, not only save time by forcing the drill, but also save drills, because the "feel" of the drill in cutting enables the operator to judge when the proper pressure is being exerted on the lever. The same applies to a hand-operated miller, and as long as the cutter remains sharp, the operator will force the feed.

Of course, everyone knows that machines with geared feeds are most efficient when operated according to the best practice; but the best practice is not in evidence in every shop.

Bending Pipe Four Feet in Diameter

Structural Steel Tower Facilitates the Bending of Large Pipe to any Predetermined Radius

By CHARLES O. HERB

PIPE up to 50 inches in diameter can be readily bent to any radius above the minimum that is practicable for the various sizes by means of equipment devised and patented by the Taylor Forge & Pipe Works, Chicago, Ill. This equipment consists of a structural steel tower, approximately 30 feet high, with an overhead unit to which are attached two swinging arms *A*, the opposite ends of which are fastened to a collar mounted on one end of the pipe to be bent.

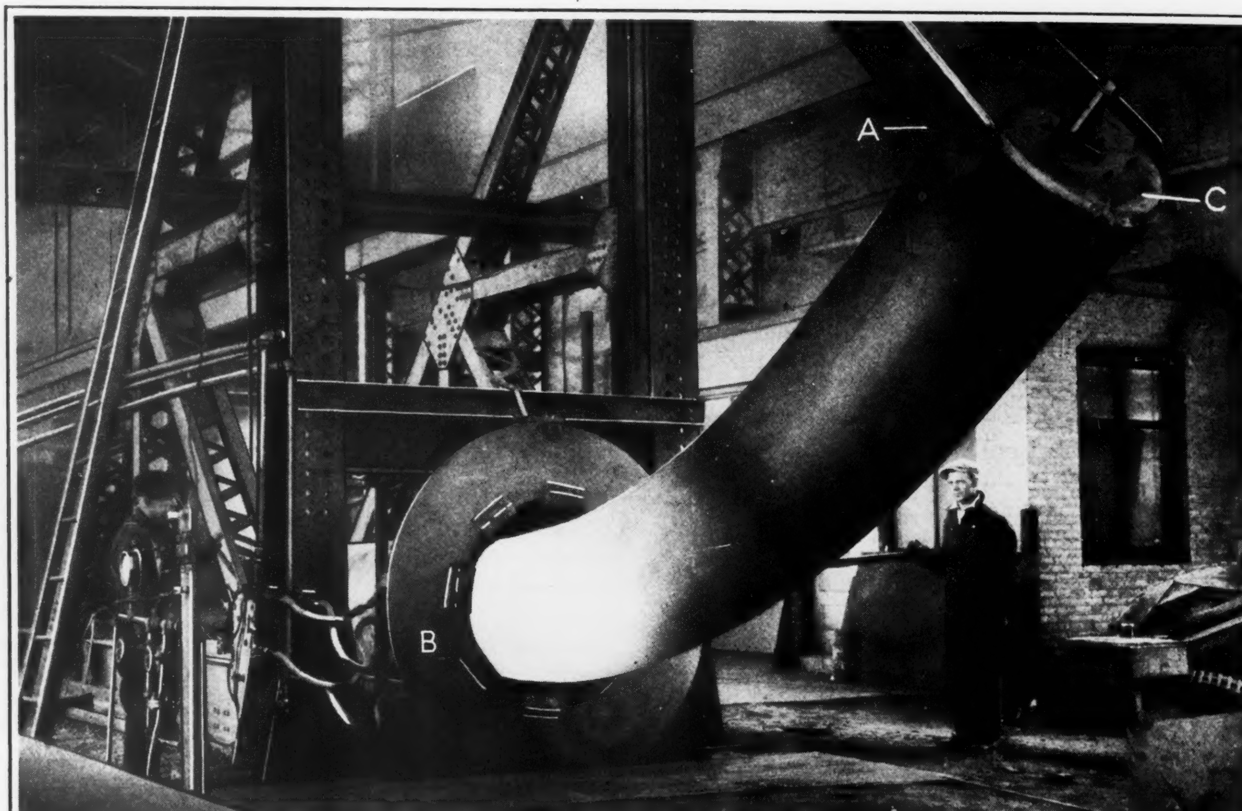


Fig. 1. Equipment Used in Bending Large Pipe Readily to any Predetermined Radius

As the heated pipe is fed through furnace *B* in the lower part of the tower, the arms *A* are swung upward, thus bending the pipe. The illustration shows an operation on 36-inch pipe. In certain operations, as will be described, it is necessary to extend the length of arms *A*. This is accomplished through a motor-driven screw in the head to which the arms are attached.

Pipe Bent with and without Sand Filling

When pipe is to be bent to a comparatively large radius, no difficulty is experienced in performing the bending operation with the pipe empty. However, if the radius of the bend is below a certain figure, which varies for each pipe size, there will be a tendency for the pipe to flatten or buckle along the inside of the curve. In such cases, it is the general custom to fill the pipe solidly with dry sand prior to the bending operation. This prevents the pipe from buckling.

At the Taylor Forge & Pipe Works, the pipe is loaded with sand while held at an angle in a cradle. First, a heavy wooden cap *C*, having an outer iron band, is driven into the lower end of the pipe. This cap contains a sleeve *D* that supports a bolt connected to one end of a long steel cable. The cable is extended through the pipe to the opposite end, where a second cap is assembled after the pipe has been filled solidly with sand. Then a nut is tightened on a bolt fastened to this end of the cable, and the cable is drawn taut.

When the pipe is in the sand-filling cradle, the sand is dumped into it from a bucket held by an overhead crane. Men with sledge hammers strike the outside of the pipe to pack it thoroughly, the pipe being rotated periodically so that blows are struck all around its circumference.

Hydraulic Power Forces the Pipe Forward During Bending

After the pipe has been packed with sand, it is carried by a crane to the bending tower. Here it

is lowered on a carriage running on tracks that extend from the front of the tower backward a distance of about fifteen feet. The carriage is actuated by water under a maximum pressure of 1000 pounds per square inch in an 8-inch cylinder, which means that a total pressure of approximately 50,000 pounds is available for moving the pipe through the furnace during the bending operation. The operator can regulate the pressure on the piston so as to control the speed at which the pipe is advanced.

Just in back of the furnace, the pipe is supported on two rollers, and there is a third roller overhead that bears on top of the pipe to prevent the part at the rear of the furnace from being lifted by the bending action. The top roller is adjustable for height to suit various sizes of pipe, and different rollers are used for the different pipe sizes.

Furnace *B* consists of twelve compact heating units, which are assembled on the back of a simple frame attached to the front of the tower. These units are mounted around the large central opening through which the pipe is pushed. They are adjustable radially to suit the pipe diameter. Water gas is used as a fuel, and this gives an intense concentrated heat at the particular point where the bend is to take place. This feature eliminates crinkling of the work during the bending operation.

How the Bending is Performed

A pipe to be bent is extended through the front of the furnace and the arms *A* attached to the pipe at the point where the bend is to start. Then the furnace units are ignited to heat the pipe to a cherry red around its entire circumference. Hydraulic pressure is built up in the cylinder of the pipe carriage so as to force the pipe forward through the furnace automatically as soon as the section being heated has reached the bending temperature.

At this temperature, the resistance of the heated part of the pipe to the tendency of arms *A* to swing upward as a result of the forward pressure of the hydraulic equipment will be overcome. Thus, the pipe will be forced through the furnace until the pressure of the hydraulic equipment is again overcome by the resistance offered by the pipe against bending. When the pipe is not hot enough to bend, the force of the hydraulic equipment is insufficient to move it on account of the tendency of arms *A* to pull it upward. Usually a pressure of 1000 pounds per square inch is exerted on the hydraulic piston at the beginning of a bending operation and then reduced to 750 pounds per square inch when the bending action starts. The hydraulic equipment is connected to the carriage through steel cables.

Templets Used for Bending to Large Radii

When a bending operation is performed in the manner described, the radius of the pipe at its center obviously equals the normal length of the arms *A*, which is about 20 feet. Pipe can be readily bent to other radii by the use of templets having an outline corresponding to the outside of the curve to which the pipe is to be bent. These templets are made up of thin wooden strips 4 or 5 inches wide by about 1 inch thick. They are placed directly beneath the pipe and a roller fastened to the pipe rides on the templet, as indicated diagrammatically in the illustration Fig. 2.

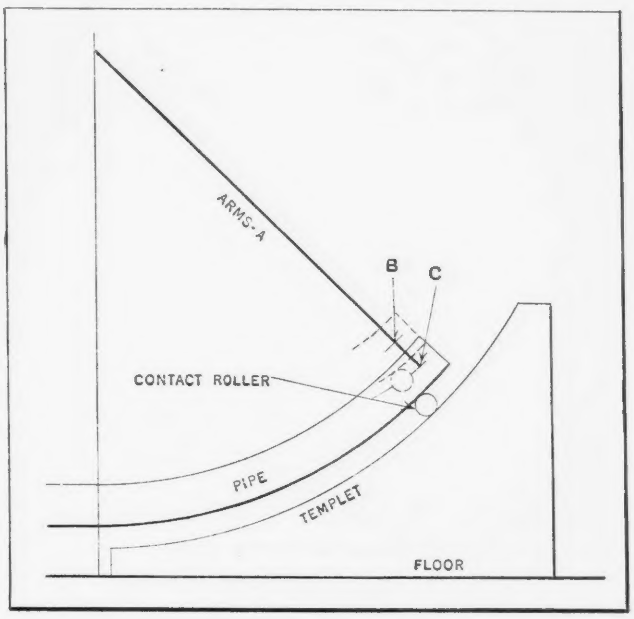


Fig. 2. Diagram Indicating How the Arms that Bend the Pipe are Lowered to Keep the Electrical Contact Roller on the Templet

When the roller is not touching the templet, as indicated by the dotted lines in this illustration, an electrical contact is made, which transmits current to the motor at the top of the tower. This motor then revolves the screw, which lowers the head to which arms *A* are attached (and thus extends the arms as from *B* to *C*) until the roller again touches the templet as shown by the solid circle in Fig. 2, at which time the electrical contact is broken and the motor stopped. By this procedure, pipe can be bent to any radius greater than the arm length. The screw that extends the arms is 8 inches in diameter and is driven by a 10-horsepower motor which transmits the power through reduction gearing.

Fifty-inch pipe with walls varying from 1/2 to 1 inch thick can be bent with this equipment. The pipe shown in the illustration has a wall thickness of 5/8 inch.

* * *

Apparently, there is still a great deal of obsolete machine shop equipment in use; at least, so we judge from the statement in a letter received from one of our subscribers. He writes: "I have recently visited a number of machine shops in this vicinity and find that many of them have two junk piles—one outside the shop and one inside. It is my opinion that the inside junk pile is more costly to the owners than the scrapped material on the outside."

How to Organize a Successful Apprenticeship

Factors that Must be Taken into Consideration in Planning an Apprenticeship System if Successful Results are to be Expected

By C. J. HARTER, General Manager
Harter Educational & Engineering Service,
West Boylston, Mass.

As mentioned in the former article by the writer, published in October MACHINERY, there are many factors that must be considered in organizing an apprenticeship system of training.

First of all, the right type of boy must be selected. Great difficulties will be encountered if any boy that comes along is accepted for the training course. It is necessary to determine, as accurately as can be done in advance, that the boy is adapted for the trade he wishes to learn. It does not pay to try to develop a toolmaker from the type of boy who would be better suited to selling ribbons in a department store. Some manufacturers will say that it is not possible to determine in advance whether or not a boy is suited to the machinist's or toolmaker's trade. It is true that it cannot be done with absolute certainty, but the experiences of many leading manufacturers in conducting successful apprentice training courses prove that one may closely approximate an ideal in making fair selections.

The best way to go about this is to have all the boys interviewed by a man experienced in handling apprentices and acquainted with their general characteristics. The responsible head for the apprentice training program should have some understanding of boy psychology. The supervisor, to be successful in guiding and controlling apprentices, must have a sympathetic understanding of their various traits. He must command respect and confidence, and, at the same time, he must be able to maintain strict discipline. In order to be able to meet all these requirements, he must have an unusual amount of what is ordinarily called "common sense."

Size and Type of Plant Must be Taken into Consideration

The organization problems involved in the establishment of an apprentice training system are of a varied character. First, it is necessary to take into consideration the type of product being made, as this will influence the whole training program. Second, the size of the plant must be considered, as this factor controls the number of apprentices that can be trained successfully. Third, the distribution of the apprentices in the various departments is essential to a successful program.

It is assumed that the purpose behind the establishment of an apprentice training system is to make available a supply of skilled men in the future, and, this being the case, the plan must be so worked out that after the first group has graduated from the training course, there will be a sufficient number of boys finishing their training courses each year to offset the personnel turnover among experienced men in the plant.

In the first year of training, it is advisable not to take any more than 5 per cent of the total number of skilled men in the shop. If 5 per cent is taken in each year, the apprentices will ultimately number 20 per cent of the skilled employes of the plant, and the number of graduates each year will approximate 5 per cent. The writer believes this to be a fairly satisfactory proportion. As all the boys do not finish their training course, the number graduated will evidently be somewhat below the figure mentioned.

The Right Kind of Apprenticeship Training Schedule is of Paramount Importance

The schedule of training for any trade should be complete in every detail before the training program is undertaken. It should include a very broad training. For instance, a mechanical drafting apprentice should receive not only the necessary instruction on the drawing board, but also adequate training in the machine shop, pattern shop, and foundry. If this plan is followed, the highest type of draftsman will be developed—that is, one who can reduce production costs by so designing machine parts that it is possible to produce them economically both in the foundry and the machine shop.

Again, a machinist apprentice should have some drafting experience. He should be given a thorough course in the reading of drawings and blueprints. This is an important precaution in preventing errors in his work. It is also essential that the patternmaking apprentice should have experience in the foundry; and, on the other hand, the foundry apprentice should have experience in the pattern shop.

The schedule of training should, of course, be adapted to each particular shop, as it is not possible to lay out a training schedule for any trade that will work to best advantage in more than one plant, even though the product manufactured may be similar.

In the next article on apprentice training systems, the author will compare the vestibule and the departmental type of training methods, and will deal with apprentice indentures, methods of stimulating the interest of the apprentice and of enlisting the cooperation of parents, rates of pay, apprentice training records, technical instruction, maintaining apprenticeships during dull periods in business, and points to be observed in order to retain the graduate apprentices.

Boring with Tungsten-carbide Tools

Design of High-speed Boring Tools Having Ball-bearing Pilots and Two Cutting Lips that are Adjustable for Size

By JAMES B. GIERN

RECENTLY, considerable attention has been directed toward the application of tungsten-carbide tools to metal-turning operations. Results have been disappointing in some cases where this cutting material has not been employed correctly, but, on the other hand, it has made possible remarkable improvements in production rates where suitable applications have been made. Present developments indicate that tungsten carbide will prove of great benefit to the entire metal-working industry when its various applications are generally understood.

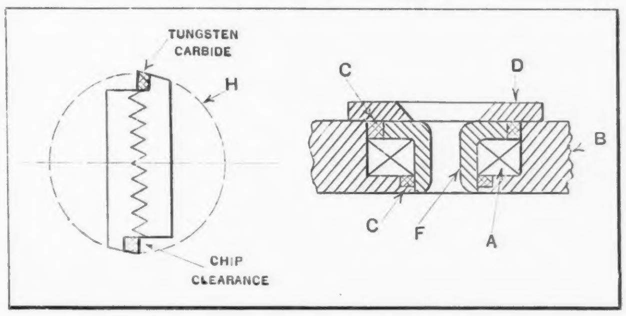


Fig. 1. Diagrams Showing Construction of Adjustable Tungsten-carbide Boring Tool and Ball-bearing Bushing for Pilot of Boring-bar

The writer has been engaged for some time in making a close study of the application of tungsten-carbide tools to high-speed boring. As this application has received comparatively little attention, the results of this study should be of interest to many readers. Judging from the results obtained up to the present time, the use of tungsten carbide for boring operations will not necessitate scrapping machinery now used for boring, especially heavy drill press equipment capable of attaining surface cutting speeds of from 200 to 400 feet per minute. On the other hand, it is the writer's opinion that drill jigs are more likely to undergo a marked change in design.

Construction of Adjustable Two-lip Boring Tool

The high cost of tungsten carbide naturally prevents it from being used for two-lip boring tools of solid construction that have no provision for expansion and cannot be reground to size. When an attempt is made to construct an adjustable tool to overcome this difficulty, another obstacle is encountered, namely, the design of a tool- or cutter-holder that will hold the tungsten carbide without allowing it to have the slightest amount of give or rocking action. In addition, the tungsten carbide must be well backed up, and there should be a generous chip clearance ahead of the cutting face. The construction of a tool that meets these requirements quite satisfactorily is shown diagrammatically in the view to the left, Fig. 1.

This tool consists of two pieces of serrated steel on which the tungsten-carbide cutting lips are mounted. The front faces of the cutting lips are located on the center line of the tool, as indicated. The serrations cut in the steel pieces have a pitch of 1/32 inch. This allows for an adjustment or expansion of 1/32 inch, which is sufficient to permit regrinding to size. The serrated blocks are accurately machined all over and are a close fit in the slot of the tool-holder, where they are held by a taper pin. The tungsten carbide is brazed on the serrated blocks which, in turn, are supported right up to the rear of the relieved portion by the boring-bar, the outline of which is shown at *H*. By having the cutters located on the center, all the strength of the material is utilized and a minimum back clearance is required.

A tool such as described has been used successfully for boring cast iron at a surface speed of 250 feet per minute, using a pilot either ahead or in back of the cutter. In some cases, it has been found desirable to support the boring-bar on both sides of the cutter and as close to it as possible.

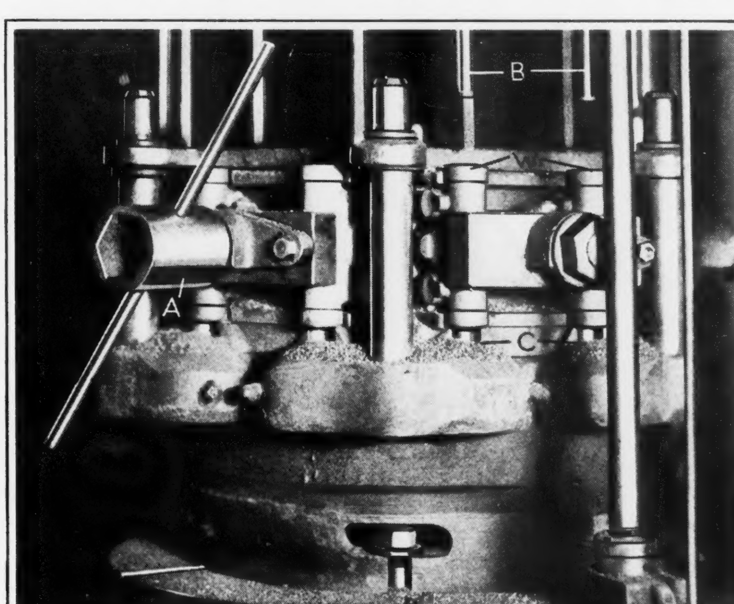


Fig. 2. Indexing Fixture Designed for Vertical Boring on Multiple-spindle Machine Equipped with Tungsten-carbide Tools

Use of Ball-bearing Pilots for Boring Tools

The high speeds at which tungsten carbide is used necessitate care in designing the pilot or guide bushings. This applies particularly to the lower bushing which guides the pilot. A double-row radial thrust ball bearing such as shown in the view at the right, Fig. 1, has proved satisfactory for this purpose.

The ball bearing *A*, indicated diagrammatically, is fitted into the pad *B* of the jig. Felt washers *C* are used to prevent dust or metal chips from entering the bearing, which is also protected by the plate *D* fitted to the top of the jig pad. The bushing *F* is a push fit in the inner race of the bearing and, of course, serves as the guiding bushing for the pilot. With this design, the pilot rotates with the bushings are of the design shown in Fig. 1, the pilots merely push the chips aside as they descend.

Example of Practical Boring-bar Design

In Fig. 3 are shown the details of a typical boring-bar of a design that has given satisfactory results. The assembly of the bar is shown diagrammatically in the upper view. The details of the shank and various parts of the bar are shown in the lower views. The pilot of the bar is guided by a ball-bearing bushing such as that previously described. There is also a ball-bearing sleeve above the tool that provides additional support close to the adjustable tungsten-carbide cutters *G*.

The shank *A* is fitted to the machine spindle and has a V-notch for a retaining screw. The collars *B* and *F* are made of bronze, as indicated in the two views in the lower right-hand corner of the illustration, while collar *D* is made of hardened tool steel and is ground on the inside to a close running fit over the balls *E*. The outside is ground to a good sliding fit in the fixture bearing. The general design of the adjustable tungsten-carbide cutters is shown at *J*. The taper screw *H* shown in the assembly view serves to clamp the cutters in the tool slot, in which they are a very close fit.

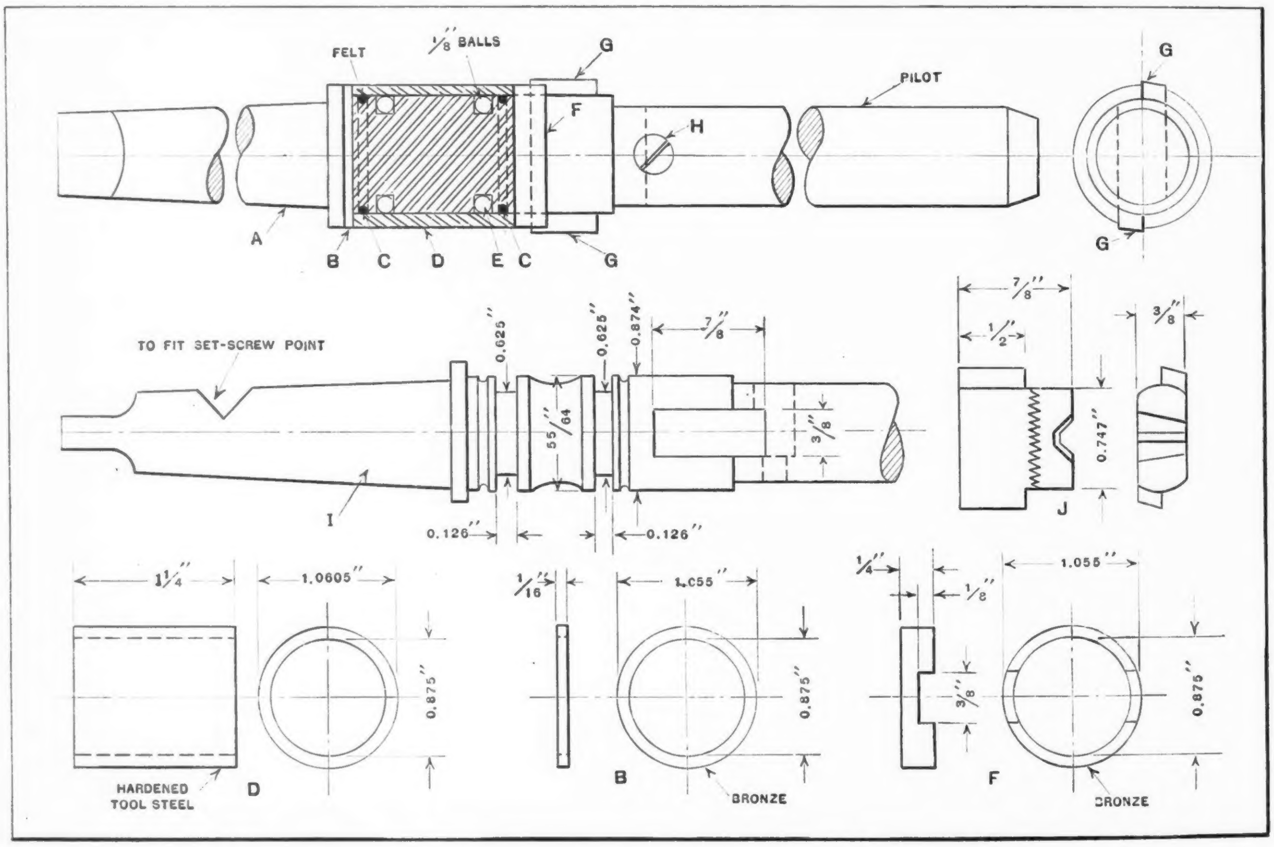


Fig. 3. Assembly and Detail Views of Piloted Ball-bearing Boring-bar Using Adjustable Tungsten-carbide Tools

bushing *F*, which, in turn, rotates with the inner race of the bearing. The pilot of the boring-bar is simply made a good push fit in the bushing *F* and, therefore, is not subjected to wear, as is the case with the ordinary pilot which rotates in the guide bushing. With this improved construction, any iron dust or chips that accumulate on the guide bearing will be pushed aside by the advancing pilot.

In Fig. 2 is shown a typical boring set-up developed for the use of tungsten-carbide tools. The work *W* is clamped securely to the indexing table of the machine at the position shown to the left. The wrench *A* is, of course, removed immediately after clamping the two pieces in place. The pilots *B* of the boring-bars are guided by ball-bearing bushings set into the body of the fixture at *C*. As these

* * *

Switzerland imports annually about 10,000 automobiles, 62,000 having been imported in the last seven years. Of these, over 21,000 came from the United States, the next largest sources of supply being France and Italy.

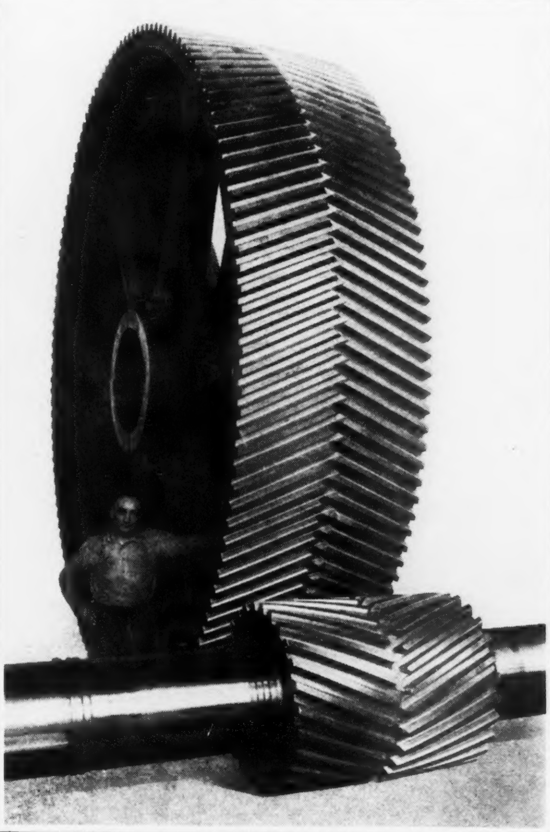
Notes and Comment on Engineering Topics

Growing Popularity of Motor Ship—Sixteen-foot Gear and Three-foot Pinion for Rolling Mill Drive—New Development in Hacksaw Blades

There is no doubt as to the growing popularity of the ocean-going oil-engine-driven ship, generally known as the "motor ship." Our British correspondent mentions that fourteen ocean-going motor ships were completed in British yards in August, having a total tonnage of 90,000 tons. During the same month motor ships of 160,000 tons were contracted for, as against only two steamships.

The American Railway Association, acting on behalf of American railways, has joined in the underwriting of the work of the American Standards Association, 29 W. 39th St., New York City. The American Railway Association will contribute $15,000 a year for three years for this work. A total of $150,000 a year has been made available through the cooperation of fifteen industrial corporations.

The illustration in the center of the page shows a gear and pinion for a reducing gear unit used in connection with two 3000-horsepower motors having speeds ranging from 90 to 180 revolutions per minute. This gear and pinion were made by the Falk Corporation, Milwaukee, Wis. They are of 3/4 diametral pitch with a face width of 4 feet. The gear has 139 teeth and, hence, is nearly 16 feet in outside diameter. The pinion has 27 teeth, being over 3 feet in diameter. The pinion bearings are 20 inches in diameter by 30 inches long, the gear bearings being 28 inches in diameter by 36 inches long. The gear was cast in one piece in the Falk steel foundry, 81 tons of metal being poured in making it. This large gear unit was made for use in the United States Aluminum Co.'s alloy mill at Alcoa, Tenn.



Large Gear and Pinion Made by Falk Corporation for Use in Connection with Two 3000-horsepower Motors for Rolling Mill Drive

A remarkable development in radio engineering has been announced by the General Electric Co., Schenectady, N. Y. This development makes it possible to use a single transmitter for broadcasting three different musical programs at the same time without interference, or six separate non-interfering addresses. The transmitter may also be used for television and voice transmission at the same time.

The 1930 model radial air-cooled "Cyclone" engine built by the Wright Aeronautical Corporation develops over 600 horsepower at its normal speed of 1900 revolutions per minute. This is nearly three times the power of the "Whirlwind" engine used by Lindbergh in his transatlantic flight; yet the new engine weighs only 60 per cent more.

The tallest welded building thus far constructed is now being erected in Dallas, Tex., for the Dallas Power & Light Co. The structure is to be nineteen stories high and will be used as an office building. The steel fabrication and erection is being done by the Mosher Steel & Machinery Co., using General Electric welding equipment. Dallas is the largest city in the United States to sanction in its building code the use of welding in building construction. So far, seventy-nine cities have adopted codes that allow welding to be used for this purpose. The only eastern cities that have taken this step are Pittsfield, Mass., Wilmington, Del., Lynn, Mass., and Syracuse, N. Y.

An unusual development in hacksaw blades has been introduced on the market by a German firm, "Barsonator" Werkzeug, G. m. b. H., Hamburg-Wandsbek, according to *Engineering*. The teeth of this saw are not of uniform size; at the front of the blade they are very fine—32 teeth per inch—and gradually increase in size toward the middle and back, where there are 20 teeth per inch. The fine teeth make it easier to start the cut, and there is less danger of breaking the teeth than there is with the usual design of blade. These blades are intended chiefly for use in hand hacksaw frames, but are said to be supplied also for power saws up to 16 inches in length.

Current Editorial Comment

In the Machine-building and Kindred Industries

NEW BUILDINGS AND OLD MACHINES

Many manufacturers, in an effort to speed up production, have erected fine new plants, provided, as far as the structure itself is concerned, with all the modern means for facilitating manufacture. But after they have taken this important step toward economical production, they offset its value by moving the old machine tool equipment into the new building, and frequently machines thirty or forty years old are placed in operation in the new surroundings. The arrangement of the up-to-date shop usually makes the handling of materials easier and more economical, but the machining processes are not speeded up and their cost is not reduced by the new shop buildings—only modern shop equipment can do that.

It is expensive to add the cost of up-to-date shop equipment to the cost of a new building, but unless this additional investment is made, the value of the investment in the new buildings may be largely nullified. As a rule, it is easier to produce economically with modern equipment in old buildings than with obsolete equipment in new.

* * *

WHY DO WE STANDARDIZE?

Committees engaged in standardization work should consider carefully the object to be attained; in most standardization work in the mechanical industries this object is interchangeability. Frequently, standardization committees go further than they should, and try to impose on the industry standards that not only provide for interchangeability but that specify details of design and methods of producing the standardized article. Such matters should be left to the individual manufacturer.

So long as the tool, part, or device that is being standardized will interchange with the products of other manufacturers, the object of standardization has been achieved. The standardization committee should not prescribe design details when these do not affect interchangeability, nor should the methods of production be specified.

If the object of standardization is to obtain a certain quality rather than interchangeability, then, of course, design details and methods of production may have to be specified; but quality standardization is something entirely different from standardization for interchangeability. Most of the standardization in the mechanical industries at present has to do with interchangeability, and the best interests of industry will be served if no effort is made to limit the initiative of manufacturers in matters of design or production.

HE MAY BECOME A CUSTOMER

The president of a manufacturing plant in which it is the practice to see all visitors as promptly as possible recently said to the Editor: "We try to be as courteous as we know how to all salesmen and other visitors, for we cannot tell who may become a customer of ours in the future." To illustrate the point, he related the following incident concerning a neighboring plant that manufactures power equipment.

A manufacturer of gears sent a sales representative to this firm with a view to obtaining its cut gear business. The representative was kept waiting for two hours with the promise that Mr. So and So would see him shortly; but at last the office boy was sent out to him with the message, "We are not interested."

About six months later the gear manufacturer increased his shop capacity and planned to add some equipment to his power plant. The firm upon whom his sales representative had called learned of this and sent a salesman to obtain the gear manufacturer's power plant equipment order. The salesman was not kept waiting two hours, but instead of receiving an order, he was asked to tell his principals that the gear manufacturer preferred to do business with people who showed good judgment. "Lack of business courtesy," said the gear manufacturer, "shows lack of business judgment. Tell your people that a little common courtesy would have paved the way for an important sale."

* * *

A MACHINE SHOP BAROMETER

A machinery manufacturer who had just shown a friend his machine shop was somewhat puzzled when asked to see the scrap heap. "This," said his friend, "is what I call the shop barometer." They fished out various scrapped parts and examined each critically. Finally the visitor said, "Well, your shop looks all right, but the barometer reading isn't very favorable. Too many parts have been rejected by the inspectors and there are too many signs of sheer waste." And so it came about that the scrap heap played an important part in the elimination of wasteful practice in that particular shop.

Perhaps there are other scrap heaps that might be examined with profit, although an inexperienced observer is likely to misinterpret the signs. The mere size, for instance, may prove misleading. A small scrap heap sometimes shows that few parts are spoiled in machining, but a large junk pile may show that old, slow-producing equipment has been placed where it belongs.

Who Selects New Shop Equipment?

Results of an Investigation to Determine How New Shop Equipment is Selected and Who Influences the Final Choice of Machines and Tools

By S. E. LARSON

THERE is much difference of opinion as to who selects new machines and tools for manufacturing plants in the machine building and metal manufacturing industries. It is claimed by many that the choice of machinery and tools is made mainly by the general executive and the purchasing department, while others maintain that the choice is made by the men who are directly responsible for production in the shop.

With the aim of obtaining definite information on this important subject, MACHINERY has undertaken an extensive first-hand investigation to determine how new shop equipment is selected and who the men are that influence the choice of machines and tools. A member of MACHINERY'S research department personally interviewed the executives of 667 concerns. The facts presented in this article are the result of this investigation.

Briefly, the purpose of the investigation was to answer the following questions:

1. Where does the demand for new equipment and plant supplies originate?

2. To what extent is the selection of equipment and tools concentrated in the hands of one or a few individuals? How far, in this day of specialized departmental activities, is the trend away from the one-man rule?

3. To what extent does the organization as a whole influence the selection and buying of machines and tools?

Every product is sold under conditions that differ somewhat from the general average rule; but, nevertheless, the findings of this investigation will prove sufficiently definite to be useful as a guide in the entire industry that manufactures machines, tools, and equipment for metal-working plants.

The total number of men employed in the machine shops selected for the detailed study on which the conclusions in the following are based was 131,200. The maximum number of men employed in any one shop was 5000, and the minimum 30.

As it will be necessary to refer to groups of executives by functional titles, it should be mentioned at the outset that these titles vary in almost every shop; but, in general, there are certain well defined duties that are delegated to one man or group of men in each shop, even though their titles vary. For example, a general foreman in one plant may be called supervisor or assistant superintendent, and in another plant, merely foreman. Likewise, the duties of a tool engineer, production engineer, and plant engineer may be equivalent to that of an equipment engineer.

Hence, to avoid too many classifications, general foremen, supervisors, and foremen have been grouped under the heading "foremen," and the title "equipment engineer" has been used for the man who is concerned with plant operations and equipment, as distinguished from the chief engineer whose work is primarily concerned with the design of the manufactured product.

In the following, the methods of deciding upon the selection of machine tools will be dealt with first. The buying of small tools, supplies, and unit mechanisms differs in certain important points from the buying of machinery and will be dealt with later in the article.

How Demand for Machine Tool Equipment Originates

The evolution of a purchase order for machine tool equipment is usually a slow process, involving the molding of the opinions and suggestions of several men into a common agreement. In 89 per cent of the shops investigated, a foreman or the superintendent made the original demand for new equipment, or was instrumental in getting the request on the way. In 18 per cent of these shops, however, it was stated that the requisition might also originate with the works manager, chief engineer, equipment engineer, or even the general manager or president of the company instead of with the superintendent or foreman.

An investigation of the number of executives who participate as consulting or recommending authorities in the purchase of machine tools indicates the superintendent to be a factor in 85 per cent of the shops, the foreman in 79 per cent, the works manager in 25 per cent, the general manager or president in 22 per cent, the equipment engineer in 16 per cent, the chief engineer in 13 per cent, the general superintendent in 11 per cent, the assistant superintendent in 11 per cent, and the master mechanic in 6.5 per cent.

The reason for the comparatively small percentages in which the equipment engineer, the general superintendent, the assistant superintendent, and the master mechanic are mentioned as direct factors in the selection of equipment is that it is usually only in the larger shops that men with such titles are found. The superintendent in the smaller or medium-sized shops—which, of course, are in the great majority—generally fulfills all the functions of the men who would carry the other titles in a larger plant.

The Foreman's Opinion Carries Weight in Most Shops

It is significant to note that the management of up-to-date shops recognizes the advisability of ob-

taining the opinions and suggestions of the foremen when new shop equipment is being considered. It is beginning to be definitely recognized that if a foreman or supervisor feels that he has had a voice in the selection of equipment for his department, he is likely to bend every effort to prove the value of his judgment when the machine is installed in the shop. The round-table method of discussing the pros and cons of contemplated equipment creates a common understanding and places a definite responsibility upon those interested.

On the other hand, if a foreman is not consulted, he will have no direct interest in proving the new machine to be a success, and he may even be prejudiced against it from the beginning. Consequently, the opinions of foremen and supervisors are more than ever becoming a factor of importance and one that must be given serious consideration in any successful scheme of sales promotion. To a somewhat more limited extent, the same applies to the higher grade of toolmakers, machinists, and machine operators.

To What Extent Does the Man Who Operates the Machine Influence its Purchase?

In order to determine whether or not the men who actually use the machines—the toolmakers, machinists, and machine operators—are a factor in the selection of new equipment, an inquiry was made to determine how much influence these men have in forming the opinion of the foreman and in the final selection of equipment. This appeared to be an unusual question and the answer had to be based for the most part on general impressions of past experience and observation.

In over one-third of the shops (36.5 per cent) the men operating the machines are a factor in influencing the opinion of the foreman. In 58 per cent of the shops it was thought that the influence of the actual shop men would be too remote to be of any consequence. In 5.5 per cent of the cases, the men interviewed were not prepared to answer this question one way or the other. It is significant, however, that in more than one-third of the number of plants investigated, the opinion of the great mass of the mechanics in the shop was recognized as a factor that influenced the ultimate purchase.

Who Makes the Final Decision?

After the ground has been prepared for the selection and buying of a new machine through the influences referred to, some one man must make the final choice. If there are conflicting opinions, his voice is the deciding one. The research shows that in approximately one-third of the number of shops (32 per cent), this man is the superintendent. In 26 per cent of the plants visited, the final choice rested upon an agreement between two men—the superintendent and some other executive, such as the president, general manager, works manager, chief engineer, or master mechanic. In 21 per cent of the cases, the final choice would lie with any one of the executives just mentioned, and in 18 per cent of the number of shops, the matter was settled by a committee of those directly interested in the equipment to be bought. No definite data were obtainable in 3 per cent of the shops.

The conclusion reached in the investigation made by MACHINERY of methods of purchasing machine tools is that modern industrial management has found it advantageous to consult not only the superintendent and the foreman, but frequently also the shop men, before buying new equipment. It has been found that the performance of a machine tool depends to a great extent on the attitude of the shop men; whether a machine will give a good account of itself or not depends largely upon the friendly or unfriendly atmosphere in which it is operated. For this reason, the foreman, and even the shop men, must not be neglected in making a successful sales appeal.

The Purchasing Agent's Duties in the Acquisition of New Equipment

The importance of the purchasing department in influencing the selection of machine tools has been widely debated; hence it is of interest to note that 87 per cent of the plants reported that the purchasing agent was not an important factor in making the selection. His function, however, consists in acting as an intermediary between the shop executives and the seller. In 6 per cent of the shops, where the purchasing agent was an important factor, he was usually an official of the company and combined the duties of purchasing with other work that placed him in a position to have a definite opinion as to the value of the equipment to be bought. In 7 per cent of the cases, no information was available on this point.

The importance of the purchasing agent, however, should not be underestimated. He is often instrumental in bringing to the attention of the shop executives information about new shop equipment that comes to him through his contact with the many salesmen that call upon him and the mail he receives. To keep the purchasing agent informed about everything that is new in the industry is, therefore, highly important.

The Shop Executives Select New Equipment

The conclusion reached in the investigation of purchasing methods, as applied to machine tool equipment, is that modern management has found it unsatisfactory to order equipment without consulting the shop executives, and in many cases the shop men are also consulted. It has been found that the performance of a machine tool—no matter how high its reputation and recognized performance value—depends greatly on the attitude of the shop men. Whether a machine will give a good account of itself or not depends largely upon the friendly or unfriendly atmosphere in which it is operated.

In other words, it is not always sufficient to "sell" the machine to the man who has the final authority

to buy. It happens, quite frequently, that if the men under the superintendent have not been convinced of the value of the new machine, it will not give satisfaction in the plant and repeat orders are not likely to be forthcoming. For that reason, the foreman, and even the shop men, must not be neglected in making a successful sales appeal.

Who Influences Buying of Small Metal-cutting Tools?

The selection of small metal-cutting tools is governed even more by the foreman and the operator than the selection of machine tools. The selection of small tools is largely influenced by the complaints and recommendations of the men who are most closely in touch with the actual operation of the tools. The likes and dislikes of these men toward any particular make of small tool have a great deal to do with their successful application. The approval of a small tool requisition rarely goes to a higher executive than the superintendent, and often the approval of the tool supervisor or foreman is sufficient to authorize the purchase.

The Purchase of Unit Machine Parts

In regard to the purchase of unit machine parts to be incorporated in a finished product built by a company, there has also been considerable speculation. How much has the chief engineer or chief designer to say in selecting the type and make of machine parts? The research analysis made by MACHINERY shows that in 30 per cent of the shops the chief engineer or designer has the final word in specifying the selection of unit mechanisms.

In 43 per cent of the plants, however, the chief engineer or designer does not specify what unit mechanisms or machine parts to buy without discussing his ideas with other shop executives. Often the sales department enters into these discussions. Through its outside contacts it can frequently supply valuable information concerning the trend of opinion among the buyers of the product and the preference for certain mechanisms. In the remaining 27 per cent of the shops no definite information was available.

General Conclusions

Briefly summarized, the investigation undertaken to determine who influences the selection of machine shop equipment indicates the importance of the superintendent and the foreman, and also emphasizes that in many instances the shop men who will operate the machines to be bought are a factor to be considered. Many other executives in the plant, of course, have a voice in the selection, and a successful sales policy cannot neglect any one of the channels through which opinion flows that will ultimately decide upon a given make or type of machine or tool. Broadly speaking, however, it is the shop and not the office that is the deciding factor.

Qualifications of a Successful Foreman

The tactless foreman prides himself on "treating all men alike," but he might just as logically take pride in applying the same heat-treatment to all kinds of steel. Men differ in analysis more widely than steels. Ordinary steels may be successfully heat-treated when the relative contents of a few elements—such as carbon, sulphur, and phosphorus —are known; and so a knowledge of a relatively few elements in human nature makes it possible to deal successfully with problems arising in shop management.

In the past it was thought that all that a foreman needed was unusual skill in his trade, so that he would know better than anybody else how the work in his department should be performed and be able to perform it himself, if necessary; but, in recent years, the functions of the foreman have become much broader. As was recently pointed out by the works manager of a large industrial enterprise, the foreman is virtually the manager of his department.

One of the foreman's important duties is to be a fair and impartial representative of the shop management to the men in his department. He must also be equally fair and impartial in representing the men to the management. In plants where the men ask for shop committees, the foremen are generally one-sided representatives. If they represented the interests of their subordinates fairly before the executives of the company, no need for special committees would be felt.

The foreman should adjust all matters over which he has authority as quickly and as fairly as possible. When conditions arise that he cannot adjust himself, he should not delay in presenting the matter to a higher executive.

Many foremen seem to think that tact and diplomacy are not consistent with honesty and frankness. In this view they are mistaken. No useful purpose can be served by arousing a man's resentment in pointing out an error to him, if the same error can be brought to his attention without sacrificing his good will. The difference between diplomacy and tactlessness in handling men is the difference between "leading" and "driving."

Some foremen have no difficulty in getting their men to adopt new methods, while others meet with stubborn resistance. This is because the successful foreman uses proper "selling" methods in introducing new ideas; he may even go so far as to make it appear to the shop men that they were really the originators of the idea. The second type of foreman tries to force the acceptance of new methods on the strength of his authority—the result usually being friction, accompanied by reduced production, higher costs, and lower efficiency.

Grinding Dies Without Removing Guide Pins

By GEORGE W. CLAUSSON, Diamond Machine Co., Providence, R. I.

In grinding the top surfaces of dies equipped with pillar posts or guide pins, it is usually necessary to remove the pins so that the grinding can be done close to the edge of the die. In some cases, this work is done by removing the pillar posts from the guide. However, this is impracticable because the pins are usually lapped in place in the punch-block, and by disturbing them, misalignment of the die members may result when they are again assembled. The time required for removing the guide pins is also a factor to be considered, and is sometimes even greater than the time required for grinding.

A special grinding head to facilitate this work has been developed recently by the Diamond Machine Co. of Providence, R. I. This head is of the swivel type, and the grinding wheel extends from it enough to allow the head to clear the ends of the guide pins. The head can be adjusted through an angle of 180 degrees in a plane parallel with the T-slots of the reciprocating table. It is designed so that straight, cup, ring, or dish wheels can be used. Also, flat or angular grinding can be performed advantageously.

One example showing the use to which this head is put is shown in Fig. 1. On the table of the grinder is secured a die having four pillar posts. The posts are not removed for grinding the surface of the die, and the grinding is done at one setting of the work. The head is set at an angle of about

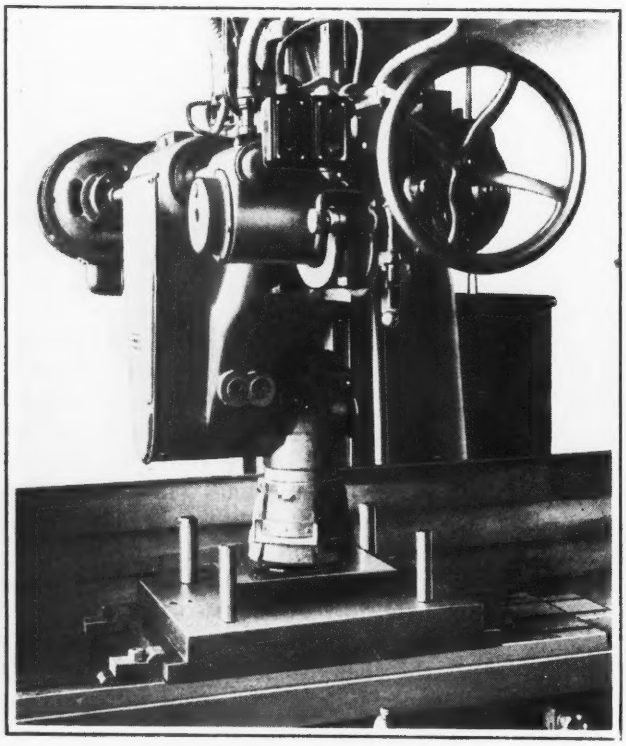


Fig. 1. Grinding Wheel Head which can be Tipped for Grinding Dies Close to Guide Pins

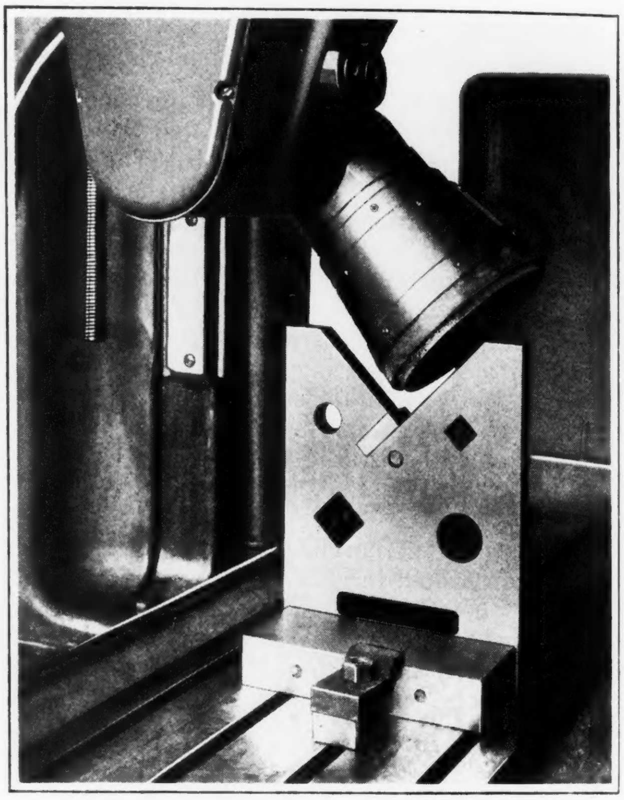


Fig. 2. Wheel-head Shown in Fig. 1, Used for Grinding Both Sides of a Vee at One Setting

5 degrees so that it will clear the die edge next to the pins, and the edge of the grinding wheel is dressed parallel with the table.

Starting at one edge, the die is ground until the wheel passes the center. The table is then stopped and the head is swung in the opposite direction, after which the remaining half of the die is ground. Because the area of contact of the wheel with the work is very small, harder wheels can be used and heavier cuts can be taken without "burning."

Cup-wheels can also be used on this grinding head. A lubricant feed through the center of the spindle provides an efficient cooling means and also serves to remove the grindings from the die surface. The guard over the wheel is so designed that it is possible to grind within one inch of the guide pins.

Another method of grinding dies is to use a cup-wheel, the surface of which is set parallel to the table. However, this method does not always prove practical, especially where a solid surface is to be ground. It is more suitable for work in which the surface is of a broken nature. Because of the large wheel contact required with this method, a great number of cuts are usually necessary to prevent excessive heating or "burning."

The possibility of any checking resulting from "burning" is less when the head is tipped, owing

to the small area of wheel contact. This head can also be used for angular grinding and side grinding. An example of angular grinding is shown in Fig. 2, where the vee in an angle-iron is being ground. Both sides of the vee are ground at one setting. After one side is ground, the head is tipped an amount equal to the included angle between the vee surfaces in order to grind the other side. Usually, this job would require two settings of the work in order to complete the grinding of the vee.

With this head, grinding of shearing angles on dies is also a simple matter, as all that is necessary after grinding the surface of the die is to tip the head the required amount without disturbing the setting of the die.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

USING LIQUID AIR FOR SHRINK FITS IN RAILROAD SHOPS

An interesting use for liquid air has been found in the making of shrink fits. Perhaps these fits should more properly be called "expansion" fits, because the part to be secured in a hole of another member is immersed in liquid air to contract it, after which it is inserted in the member to which it is to be fitted. The expansion of the member that has been immersed in liquid air, when it returns to normal temperature, holds it securely in place.

One application of liquid air for this purpose is in railroad shops. The problem of replacing bushings in brake beam hangers of cars and locomotives, spring equalizer hangers, and other locomotive and car parts, has been simplified by the use of this new process. Instead of forcing the bushings into place by hammering or pressing, liquid air is used for shrinking over-size bushings so that they can slip into the holes in which they are to be fitted.

In the past, bushings made from steel, iron, and bronze have been turned from 0.003 to 0.018 inch over-size, according to the diameter of the bushing, and have been either pressed into place by a hydraulic press or driven into place by a steam hammer. These methods usually distort the bushings, causing them to become out of round.

Liquid air has a temperature of about 312 degrees F. below zero, and hence, any bushing when immersed in liquid air will contract quite rapidly. The liquid air is contained in a balsa wood box, the size of which, for ordinary railroad work, may be 8 by 12 by 18 inches. The bushings are immersed in the liquid air for about 5 minutes, after which they can be easily dropped into place in the part to which they are to be fitted. The new method is claimed to represent a considerable saving in the cost of inserting the bushings; and in addition, bushings fitted by the aid of liquid air give longer service, because they are not distorted in the assembling operation.

In one of the New England locomotive shops, liquid air has been used to contract steel, iron, and brass bushings. A shrinkage allowance of 0.0027 inch per inch of diameter has been found satisfactory for Shelby steel tubing, and an allowance of 0.0037 inch per inch of diameter for bronze bushings. Bushings made from what is known as "double-refined iron" have been successfully assembled with an allowance of 0.0021 inch per inch of diameter.

In order to determine how tightly these bushings were held in their component parts, a Shelby steel bushing about 3 inches in diameter was pressed out by hydraulic pressure. It was necessary to apply 30 tons of pressure to start the bushing, and this pressure had to be maintained at 20 tons until the bushing was fully removed. For a double-refined iron bushing 2 7/16 inches in diameter, the corresponding figures were 20 and 10 tons, respectively.

In one of the New England railroad shops, twenty-seven passenger coach, truck brake-beam hanger bushings were applied by the aid of liquid air. These brake-beam hangers are now in service and under observation. So far, they have given complete satisfaction.

PNEUMATIC BENDING PRESS

By H. H. HENSON, Foreman, Machine and Erecting Shop, Southern Railway Co.

Bending arch bars for car trucks and elliptical springs for locomotive or tender trucks, as well as riveting draw-heads, is accomplished in the machine shown in the illustration. This machine is operated pneumatically, and was constructed primarily for use on the type of work mentioned, although it may be adapted to other jobs.

The base *A* is made from a piece of 24-inch I-beam, 7 inches wide and 65 inches long. To the top of this base is secured the die-holder *E*. At one end of the holder is a projection through which the shank of the ram *O* slides, while at the other end is another projection which serves as a stop to support the dies while in use.

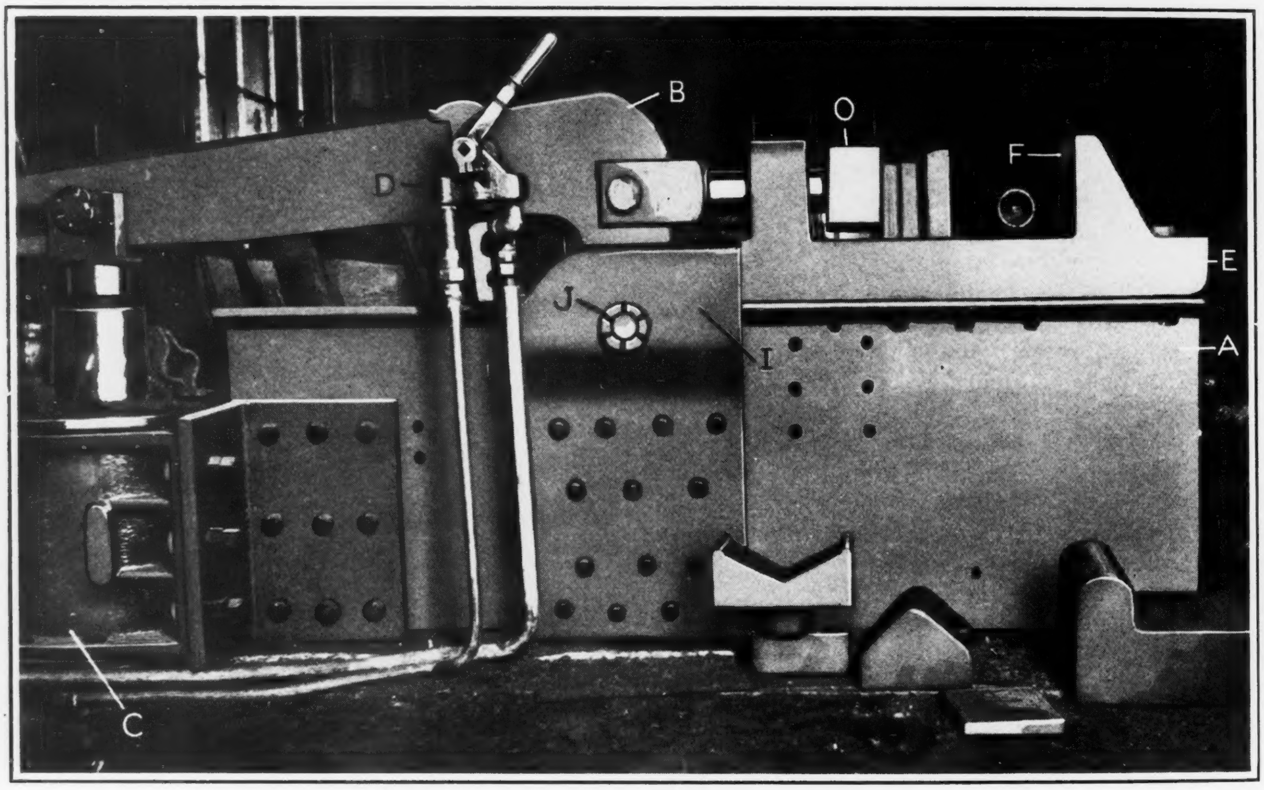
The ram is actuated by the air cylinder *C*. Lever *B* is pivoted at *J* in the plate *I*, which is secured to the base by means of rivets. The piston of the air cylinder is connected to one end of the lever, while the other end is pivoted to the shank of the ram *O*. Air is supplied to both sides of the piston in the cylinder through a three-way valve which may be seen at *D*.

In operation, as the air is admitted against the bottom of the piston, the left-hand end of lever *B* is elevated. This movement causes the ram *O* to be forced toward the right, closing the dies, which are mounted in the holder *E*, under a high pressure. The high pressure is produced because of the great leverage obtained by positioning the fulcrum points of the lever advantageously.

GLASS ENCLOSED INDUSTRIAL LABORATORY

The new laboratory of the A. O. Smith Corporation in Milwaukee, previously referred to in MACHINERY, may be said to be practically glass enclosed. With a view to reducing the use of artificial light to a minimum, three sides of the new building are equipped with wide V-shaped windows extending from the first floor to the attic sill, a distance of approximately 100 feet. Each side of this vee will be made of a single sheet of plate glass, 14 feet high for each floor. There are six of these V-shaped windows in the front of the building and eight on each side. The spandrels of the windows are made of aluminum, so constructed as to be reduced to a mere line of metal.

All the windows of the building are fixed in position and have no part in the scheme of ventilation, which is adequately taken care of by a complete mechanical air-conditioning system; this system maintains the air at a uniform temperature and humidity winter and summer.



Air-operated Press Used for Bending in a Railroad Blacksmith Shop

A few types of bending dies are shown near the base of the machine, these dies being made to suit the work to be done. In order to locate the dies properly on the machine, a hole is provided in the center of the projection *F* in which a dowel, secured in the die, engages. The machine is anchored on a concrete foundation by 1-inch bolts, and is located near a heating furnace. Crane service is also accessible, thus facilitating operations.

* * *

We cannot overlook the fact that our present highly developed science of mass production is attributable more to the tool engineer and tool designer than to any other single individual in our manufacturing organizations.—*O. B. Jones, in a paper read before the Production Meeting of the Society of Automotive Engineers, Detroit, Oct. 7-8.*

* * *

PROPOSED STANDARD FOR MACHINE PINS

The Committee on Machine Pins of the American Society of Mechanical Engineers, 29 W. 39th St., New York City, has published a proposed American standard for straight and taper pins as used in the machine industries. The proposed standard is entitled "Machine Pins." Copies will be sent to those interested upon request. Suggestions and criticisms are invited, and should be sent to C. B. LePage, assistant secretary of the Society.

The Shop Executive and His Job

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

PRACTICAL RESEARCH WORK

The writer is in complete agreement with the views stated on the subject of research on page 10 of September MACHINERY. An important point to consider in this connection is that the results should be recorded. Shop men shy at written reports, and hence the conclusions of practical research work conducted in the shop are usually conveyed verbally to those interested before being put into practice. A year or two later, the practice may be questioned, and all that can be recalled is that it is based on results of some tests made in the shop. The details are forgotten and the whole process may have to be repeated, or the practice may be changed to one less advantageous without any real investigation.

The facts pertaining to practical research work should be recorded at the time the tests are made. The report need not be elaborate; it may state merely the materials used or tested, an outline of the methods of conducting the tests, and the conclusions reached. Tabulated results should be included. This report can be filed and indexed in its rough form. Very little extra work is required, but in this way, the results of practical research work become part of the permanent information of the organization. LEON J. LICHTENSTEIN

SALARY OR HOURLY PAY FOR FOREMEN?

The foreman should be employed on a salary basis. He is a part of the executive staff and should be considered so; as such, he is entitled to have his weekly pay guaranteed. In return, he is expected to use his mind as well as his hands in behalf of his employers. Any worthwhile foreman is always on the alert to find ways and means to increase production and improve quality. He does not stop thinking about his problems when the whistle blows, and for that reason he is entitled to being relieved from worry about his weekly pay.

CHARLES R. WHITEHOUSE

There is no more definite way in which to encourage good leadership and instill ambition in foremen than by changing their status from the hourly rate to a salary basis. A foreman is paid, not for the time he puts in, but for giving his best efforts to obtain the results that the management seeks. It is from the salary type of employe that the company with which the writer is connected has developed its best executives. The right type of man, when placed on a salary basis, forgets the clock and is likely to take home with him many of the problems that have been presented to him during the day. A fixed weekly salary relieves the mind from worry over the pay envelope and encourages a man to think of his own and the firm's interests as identical. CHARLES H. WILLEY

The writer is inclined to favor the hourly rate. Foremen who would abuse the hourly rate by working over-time unnecessarily for their own benefit are in a very small minority. Working on a weekly salary basis produces foremen who seek favor by continually working over-time when they could do all their work in regular hours. I believe that the weekly rate develops procrastination. Things that should be decided or done immediately are put off until after hours, and the man who does this never quite catches up with his work. Credit often goes to the wrong man, because by working over-time he appears to have the interests of the company at heart, when, in reality, the over-time work is the result of slow methods of thinking and action. It is better, in my opinion, for a man to give all that he can in the regular hours and to work overtime only when emergencies arise; and for such over-time, payment on an hourly basis is logical.

ELI SMITH

THERE SHOULD BE NO BONUS FOR BEING ON TIME

A bonus is properly paid for unusual skill and effort, if it results in increased production of a predetermined quality; but time put in alone is not proof of dependability—it is only one characteristic out of many required to make a first-class workman. Mere attendance is not usually a justification for a bonus payment.

JOHN H. WOODHULL

I do not believe in a punctuality bonus because it is fundamentally unsound to pay an employe a premium for doing that which he is already paid to do. It is better to attack the problem on the score of good management that firmly insists on getting what it is paying for. A foreman or superintendent should get from his men all that they may be reasonably expected to do and are paid for doing, without special "tricks." The present is a good time to get down to bed rock in management methods and to re-learn the art of getting results directly. ELI SMITH

SHOULD PRODUCTION BE GUARANTEED?

I was very much interested in the editorial in October MACHINERY "Should Production be Guaranteed?" It is my opinion that machine tool builders are too much inclined to make definite guarantees of what their machines will do, with the buyer retaining control over the shop conditions and the manner in which the machines are handled. I feel that machine tool builders should avoid making definite guarantees unless the control of the situation is turned over to them during the demonstration period. MACHINE TOOL BUILDER

TRAINED OPERATORS ARE ALSO NECESSARY

It has been pointed out in MACHINERY that the best results cannot be obtained from machine tool equipment unless the tools and other accessories, such as tool- and work-holding devices, are just as good as the machine; but there is still another factor—the operator. The man who operates the machine must understand its use, capacity, and the methods of getting the most out of the machine. A properly trained operator, therefore, is just as important as a good machine and good tooling equipment. In many instances, the training of the operator is overlooked, with the result that only a fraction of the value of the machine and tool equipment is actually made use of. OBSERVER

TEACHING OPERATORS TO READ DRAWINGS

Many shop men make mistakes because they are unable to read drawings and blueprints correctly. A brief course of instruction in the reading of blueprints would be a great help to these men and would make them more valuable. A large manufacturing concern has included blueprint reading as one of a dozen courses given to the employes after working hours. The course consists of ten lessons, and is well attended in spite of the fact that a fee is charged. The men realize that the ability to read blueprints is valuable to them. It is easy to arrange for classes in blueprint reading; why should not more concerns do so? GEORGE A. FISCHER

SHOULD TIME BE ALLOWED FOR WASHING UP?

It is the practice in many New England shops to allow the workers from three to ten minutes for washing up. In our plant we allow all men three minutes, and all women six minutes for washing up at noon and night. Women employes are permitted to ring out before the three-minute bell rings, to avoid congestion at the time-clocks when the men leave.

I do not think that the workers should be allowed to wash up and get ready to leave while their machines are running. There must be a fixed rule, because there are always a few people in every organization that will abuse the privilege of using their own judgment. In such cases, the privilege is often revoked to the detriment of those who do not abuse it.

In most instances, tardiness is due merely to carelessness. Usually, it is only necessary to talk to the offender once or twice, and point out the folly of being habitually late. We check up on our employes about once a month, and those who have poor records for punctuality are spoken to, and are checked up later to note any improvement.

WILLIAM C. BETZ

GIVE A MAN A CHANCE TO STATE HIS GRIEVANCE

When the average man has a grievance, be it real or imaginary, he is not able to work at his best until it is "off his chest." It is an important management problem to provide for this condition. In every organization, there should be some kind of "personnel superintendent" who would be accessible to the workmen at all times and to whom they could state their grievances. Many of these grievances, particularly the imaginary ones, solve themselves by the mere telling of them.

A personnel man who is sincere and who makes the men feel that he is really interested in them and in their problems, can settle most of the difficulties that arise without taking them to the "big boss"; but this man should be the channel through which the men could approach the chief executive if necessary. Or a shop committee elected by the men might serve as the intermediary between them and the chief executive.

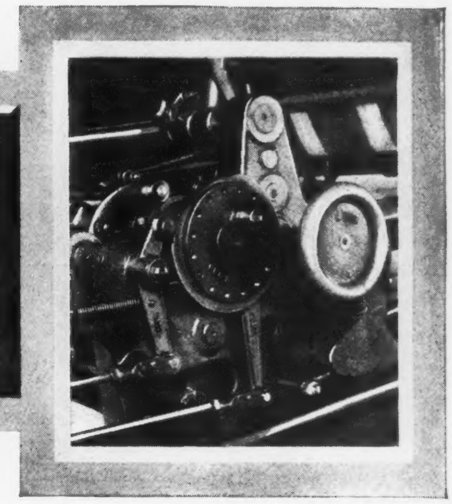
In the case of grievances on the part of a foreman, the situation is somewhat different, as a request by a foreman for permission to take up a matter with the chief executive, may reasonably be expected to be frankly granted by his immediate superior. HARRY KAUFMAN

MATERIALS SPECIFICATIONS FOR THE SMALL SHOP

The standardization of materials specifications is a difficult problem for the small or medium sized shop because of the expense involved. A big organization can afford to spend some time and money working up specifications for materials and supplies, but the smaller plant can hardly afford to do this.

This being the case, why cannot the smaller plant utilize the specifications already worked up by the Federal Government? The Federal Specifications Board has analyzed the material requirements for the various government departments, shops, and arsenals, and the resulting specifications generally cover the subjects very well for average requirements. They apply to hundreds of items used in the average shop; copies of these specifications can be obtained for the asking. JOSEPH BELL

Ingenious Mechanical Movements



MECHANISM FOR OPERATING FIXTURE LOCK-PIN

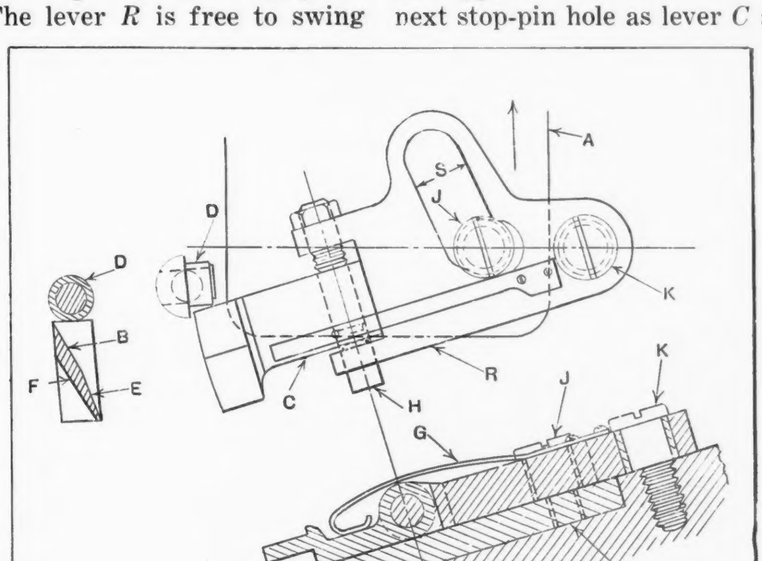
By L. F. WHITACRE

A semi-automatic facing fixture used on a single-spindle drill press carries six castings that are equally spaced around the circular table of the fixture. As each casting is indexed around to the machining position, where it is faced by a profile cutter, the fixture table is locked in the proper position by a 3/8-inch tapered pin which enters a tapered hole. The mechanism to be described is for operating this stop-pin. The illustration shows sectional and plan views of the stop-pin mechanism. The slide *A*, which is located on one side of the fixture, has a stroke of 1 5/8 inches. One and one-half inches of this stroke are utilized for indexing the fixture 60 degrees and the additional 1/8-inch movement is all that is necessary for withdrawing the stop-pin.

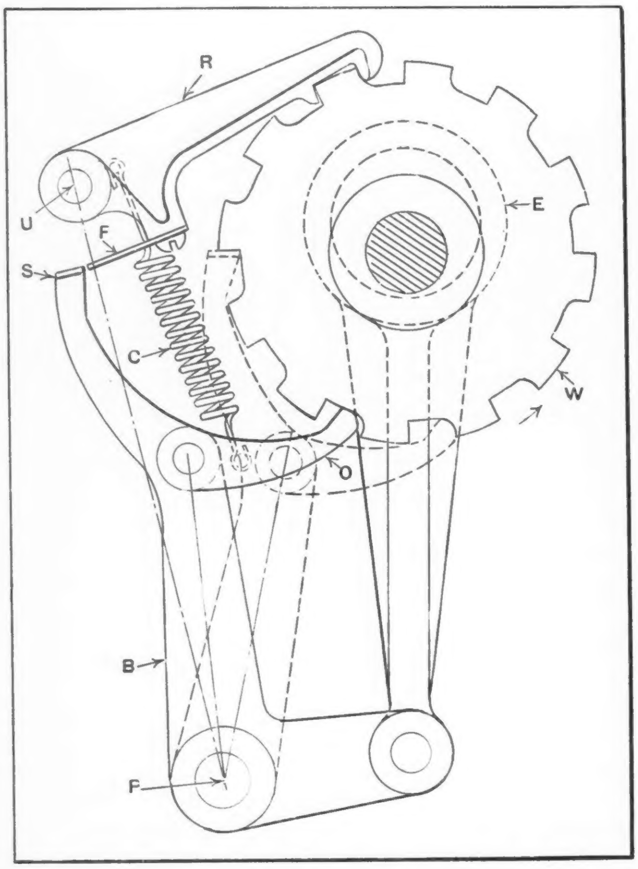
Attached to slide *A* is a pin *J*, which engages a slot *S* in lever *R*. The lever *R* is free to swing about the fixed pin *K*, and carries an extension *C*, which is free to swing about pin *H*. The outer end of lever *C* has inclined surfaces *B*, *E*, and *F*, which come into contact with a roller *D* on the stop-pin when lever *C-R* is turned about pin *K*.

The plan view shows the mechanism in the position it occupies just before the stop-pin is withdrawn. When slide *A* moves in the direction of the arrow, pin *J*, acting against lever *R*, brings inclined surface *B* beneath roller *D;* 1/8-inch movement of slide *A* is sufficient to lift the stop-pin out of engagement. Before roller *D* has passed the end of surface *E*, the hole from which it was withdrawn has been moved from beneath the pin by the indexing movement of the fixture derived from slide *A* through a pawl (not shown), which engages one of six indexing pins. Soon after the end of surface *E* has passed roller *D*, the swinging movement of the hinged lever *C-R* discontinues, as slot *S* has moved around to a position parallel to the movement of slide *A;* consequently, slide *A* and pin *J* continue their movement without affecting the position of the slotted lever, and this additional movement of *A* is utilized to index the fixture 60 degrees.

During the return movement, slide *A* ejects the machined casting. When pin *J* engages the curved end of slot *S*, the lever *C-R* is forced back to the position shown, and the inclined surface *F* engages the opposite side of roller *D*, forcing it into the next stop-pin hole as lever *C* swings upward about the pin *H* against the action of spring *G*. As soon as the end of lever *C* has passed roller *D*, the lever is forced downward by spring *G* to the position shown in the sectional views. When in this position, lever *C* rests against slide *A*, as shown by the lower sectional view. The fixture is now in position for machining the next casting, after which the cycle of operations just described is repeated. The pin *H*, about which lever *C* swings, is made



Mechanism for Operating the Pin that Locks Table of Fixture During Machining Operation



Ratchet Mechanism Designed to Move a Heavy Load Intermittently and Accurately

adjustable to compensate for wear or for variations caused by regrinding the chasers and the edges of the facing tool.

* * *

RATCHET MECHANISM FOR UNIFORM MOVEMENT AND HEAVY DUTY

By RALPH A. GLEASON

The ratchet and pawl mechanism here illustrated was designed for moving, intermittently and accurately, a heavy load at medium speed. The ratchet wheel is positively locked during the idle period, and a positive stop prevents over-travel and insures uniform intermittent movements.

The ratchet wheel *W* is free to turn on the driving shaft, which is shown in section. Behind the ratchet wheel and attached to the driving shaft there is an eccentric *E* connecting with the short arm of bellcrank *B*, which is pivoted at *P*. The operating pawl *O* is pivoted to the long arm of the bellcrank. Pawl *R*, which locks the ratchet wheel during the idle period, is pivoted at *U* and is shown in the locking position. Both pawls *O* and *R* are normally held in engagement with the ratchet wheel by coil spring *C*, which is attached to each pawl. At the upper end of the long arm of the bellcrank there is a steel plate *S* which engages a flat spring *F*, thus lifting the locking pawl *R* to which spring *F* is attached.

This ratchet mechanism will operate with the constant-speed driving shaft turning in either direction in relation to the ratchet wheel. The eccentric *E* attached to the shaft starts and stops the load gradually like a crank; the full and dotted lines show the extreme positions of bellcrank *B* and pawl *O*. Before pawl *O* comes into engagement with a tooth on wheel *W*, plate *S*, by engagement with spring *F*, lifts pawl *R*, thus unlocking the ratchet wheel.

A short movement of plate *S* causes it to pass the center line between pivots *P* and *U*; consequently, it is soon disengaged from spring *F*, but not until pawl *O* has moved wheel *W* about half a tooth, so that when plate *S* passes spring *F*, the hook end of pawl *R* falls on top of the next approaching tooth. Before pawl *O* reaches the end of its forward movement, plate *S* enters a space ahead of the radial face of an approaching tooth, so that this tooth face comes into contact with plate *S* at the end of the stroke, and any over-travel is thus prevented. During the backward movement of plate *S* to the starting position, it strikes spring *F* and bends it upward slightly, which insures seating the locking pawl firmly.

This ratchet mechanism has a ratio of 12 to 1, there being twelve turns of the driving shaft to one complete turn of wheel *W*. The connection between the ratchet wheel and the driven member which it operates is through gearing not shown.

* * *

DEVICE FOR MAINTAINING CUTTING ANGLE OF TOOL WHEN TURNING CAMS

A special movement, embodied in a camshaft lathe built by Ludw. Loewe & Co., Berlin, N.W. 87, Germany, controls the turning tool by two sets of cams, so that the cutting angle in relation to the cam outline will always be the same. A partial cross-section of the lathe showing the carriage slide can be seen in Fig. 1. Both the cam at the top and the one at the left revolve at the same number of revolutions per minute as the camshaft to be machined. The cam at the left is used as a master while the top cam controls the swinging motion of

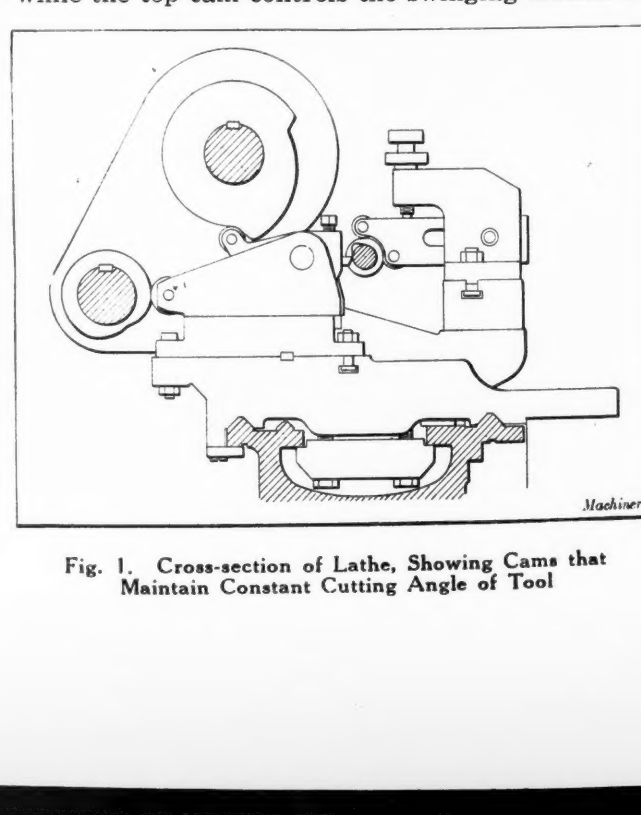


Fig. 1. Cross-section of Lathe, Showing Cams that Maintain Constant Cutting Angle of Tool

the tool about the horizontal axis in such a way that the cutting angle remains constant.

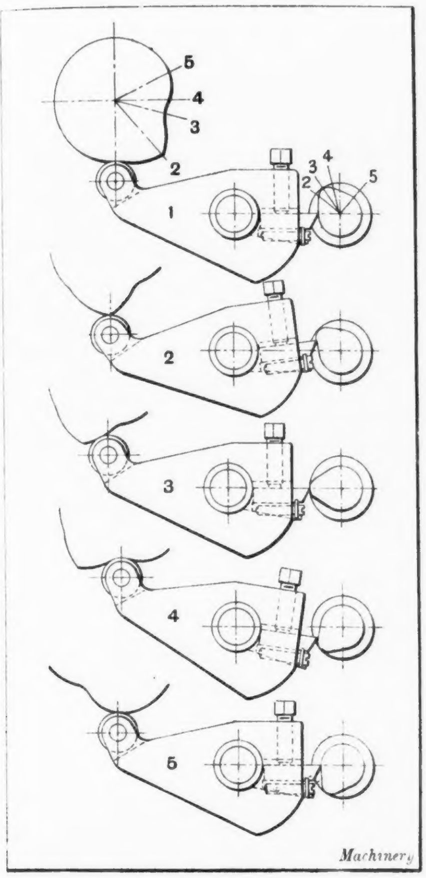


Fig. 2. Different Positions of Cutting Tool in Relation to Cam Surface

Referring to Fig. 2, the different positions occupied by the tool as the work revolves is shown. It will be seen that, with the combined movements of both cams, the desired result is obtained. The master cam at the left in Fig. 1 is ground accurately in the lathe by using a grinding wheel of the same size in place of the cam roller, while a suitable member engages a revolving cam of correct form on a shaft between the lathe centers.

* * *

GEARLESS TRANSMISSION FOR ANGULAR DRIVES

By F. E. SHAILOR

An unusual form of transmission for shafts located at an angle is shown by the accompanying illustration, which includes a side view and an end view. Motion is transmitted from the driving to the driven shaft through rods which are bent to conform to the angle between the shafts. These rods are located in holes equally spaced around a circle, and they are free to slide in and out as the shafts revolve. This type of drive is especially suitable where quiet operation at high speeds is essential, but it is only recommended for light duty.

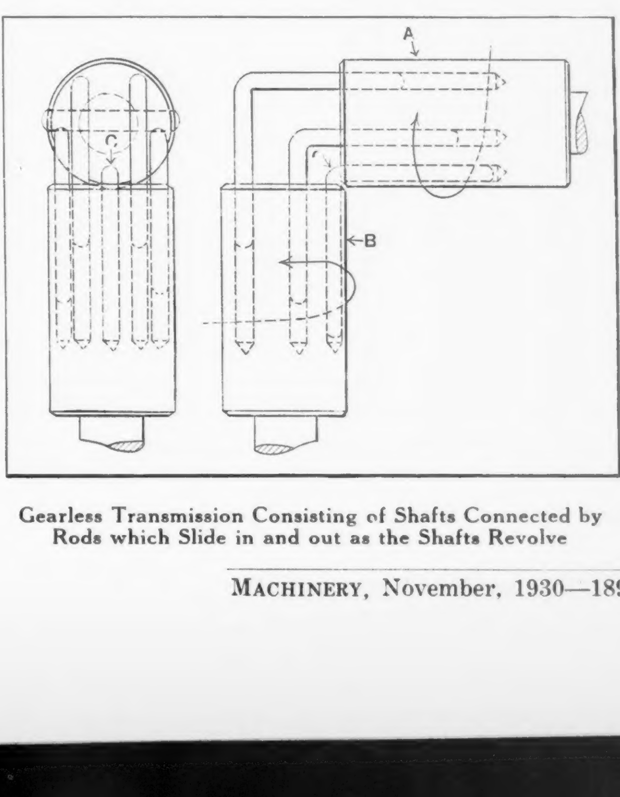
The operation of this transmission will be apparent by following the action of one rod during a revolution. If we assume that driving shaft *A* is revolving as indicated by the arrow, then driven shaft *B* will rotate counter-clockwise. As shaft *A* turns one-half revolution, rod *C*, shown in the inner and most effective driving position, slides out of both shafts *A* and *B* during the first half revolution, and rod *C* will then be at the top; then during the remaining half, this rod *C* slides inward until it again reaches the innermost position shown in the illustration. In the meantime, the other rods have, of course, passed through the same cycle of movements, all rods successively sliding inward and outward.

Although this transmission is an old one, comparatively few know about it; moreover, many mechanics are skeptical about its operation. However, it is not only practicable, but has proved satisfactory for various applications, when the drive is for shafts located permanently at a given angle. Although the illustration shows a right-angle transmission, this drive can be applied also to shafts located at any intermediate angle between 0 and 90 degrees.

One application that proved very successful was on a special multiple-spindle drilling machine for drilling meter cases in one of the plants of the General Electric Co. This machine had between thirty and forty spindles equipped with small drills which revolved at 1500 to 1800 revolutions per minute. This transmission was used to replace universal joints consisting of forked ends, each of which was pivoted by means of screws to a connecting block. These universal joints rapidly deteriorated, but the sliding rod transmission proved durable and quiet.

In making this transmission, it is essential to have the holes for a given rod located accurately in the same relative positions in each shaft; all holes must be equally spaced both in radial and circumferential directions. The holes in each shaft must also be parallel to each other, and each rod should be bent to the angle at which the shafts are to be located.

If the holes drilled in the ends of the shafts, have "blind" or closed ends there ought to be a small vent hole at the bottom of each rod hole for the escape of air compressed by the pumping action of the rods. These holes are also useful for oiling. To avoid "blind" holes, the shafts may have enlarged ends with holes extending clear through the enlarged part or shoulder. This transmission may be provided with a central rod, located in line with the axis of each shaft and provided with a circular groove at each end for a cross pin to permit rotation of the shaft about the rod, the central rod simply acting as a retaining device for shipping or handling purposes.



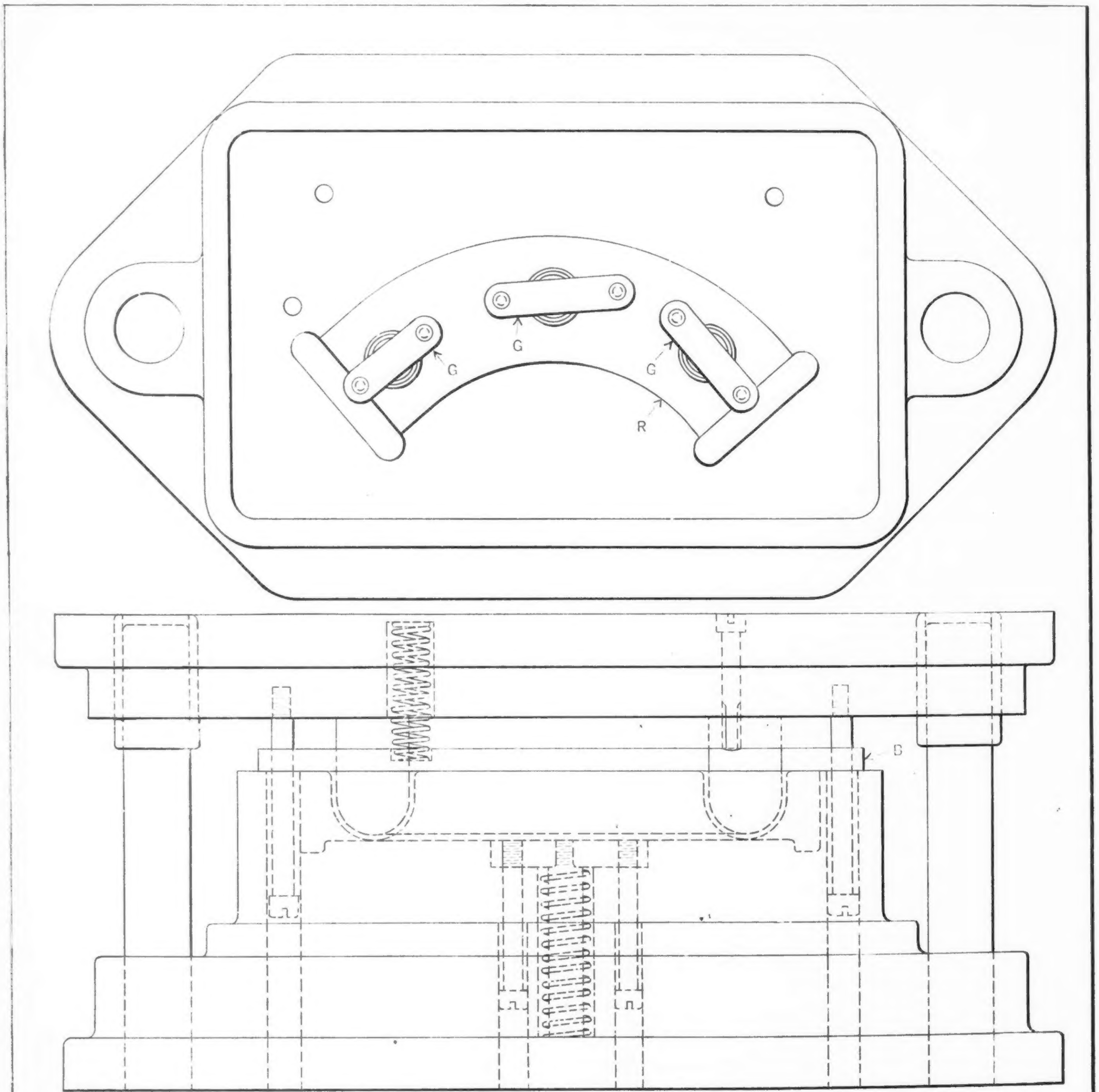
Gearless Transmission Consisting of Shafts Connected by Rods which Slide in and out as the Shafts Revolve

Making Cast-iron Dies Weighing Four Tons

The Construction of Dies for Work as Long as 92 Inches Requires a Special Procedure—Otherwise the Die Cost May be Prohibitive

By C. W. HINMAN, Tool Designer, Kobzy Tool Co., Chicago, Ill.

THE problems encountered in the design and construction of large forming punches and dies are obviously more difficult than those involved in the production of the smaller types. In the plant where the writer is employed, a punch and die was made recently, the blank for which was 92 inches long, with a width varying from 12 to 22 inches. Some of the tools made by this concern weigh from one to four tons. The need for economy in making dies of this magnitude is obvious, because of the material and labor involved in their construction. As dies of this class have seldom been described, it is believed that a description of their general design will be of interest.



Forming Die of the Heavy Type in which the Forming Faces are Cast to Size

Patterns for Dies Made of Plaster-of-paris

In making these tools, a sheet-iron sample blank is first shaped to correspond as nearly as possible to the part drawing. This blank is then formed in a screw press by the aid of temporary blocks. When the part is of a complicated nature, this method may be used as far as is practicable, the remainder of the sample being pieced together by means of an electric spot welding machine.

After the sample is made up, it is sent to the pattern shop with the tool drawing and instructions. First, the patternmaker makes the punch pattern from wood sections, so that it fits nicely inside the metal sample. Next, he covers the working parts of the punch pattern with paper of the same thickness as the sheet metal from which the part is to be formed. Then he makes a wooden block for the lower part of the die-shoe. This block is made detachable from the die pattern in order that it may be used as a pattern for casting the punch-holder.

Locating the punch with the paper attached in its actual operating position over this block, he molds the plaster-of-paris die pattern around it. When the plaster-of-paris has set, he removes the punch, after which the paper is detached and the usual black shellac is applied to the members. The foundryman has instructions not to rap these patterns excessively in removing them from the molds, so that the forming sections of the die will not be distorted.

Die Members Finished by Hand Grinding

The castings that are made from these patterns are first planed on the top and bottom. The working parts of the punch and the die cavities are then ground by hand, using a portable electric grinder driven by a flexible shaft. The grinding wheels are changed frequently for more convenient shapes, especially when grinding out the die cavity. No more metal than is absolutely necessary should be ground off. In fact, where possible, the scale should be left intact. As an aid in grinding the die correctly, it is sometimes necessary to use templets.

Typical Example of a Heavy Die

In the illustration is shown a forming punch and die of the larger type in which the actual forming members are made entirely of cast iron. This die is employed for forming a half section of a sheet-iron elbow. The ironing plate *B* is made of cold-rolled steel. This plate serves as a blank-holder and irons out the blank as it enters the die. Strong coil springs are arranged to provide the pressure for ironing the blank where the metal will crimp most as it flows over the edges of the die. This crimping of the metal will, of course, be greatest along the edge of the bend having the smallest radius, as shown at *R*.

All the top edges of the die are given a radius of from 3/8 to 1/2 inch. These edges are made very smooth, so that the metal will slip over them easily as it enters the die. The blank is located on the die member by means of a series of projecting pins which form a nest. The spring pads *G* are made of tool steel and are hardened. They are normally flush with the top of the die, and their faces are knurled by means of a sharp diamond knurling tool to prevent the blank from slipping sidewise in relation to the punch as the latter descends.

Construction of Blanking Die

Having the forming die completed, the blank can now be developed. This is done by the aid of an approximate outline of the blank cut from paper and laid out by the tool designer. Usually, however, some changes are made before the blank is developed to the correct form.

After the forming die is completed, the work of making the blanking punch and die may proceed. The shearing members of the blanking die are of the sectional type. That is, contour sections of hardened steel are arranged to correspond with the perimeter of the blank, and are screwed and doweled to the punch and die blocks. A pad for ejecting the blank is located inside the die in the punch-holder in which the die member is secured.

The stock used for the blanks is sheared along the grain of the metal in order to facilitate forming without tearing the blank. Tearing, however, seldom occurs in forming dies of the type described, because of the unusually large radii on both the work and the die. Although a forming die of this type is usually made for small quantities, it will stand up well in the manufacture of many thousands of parts.

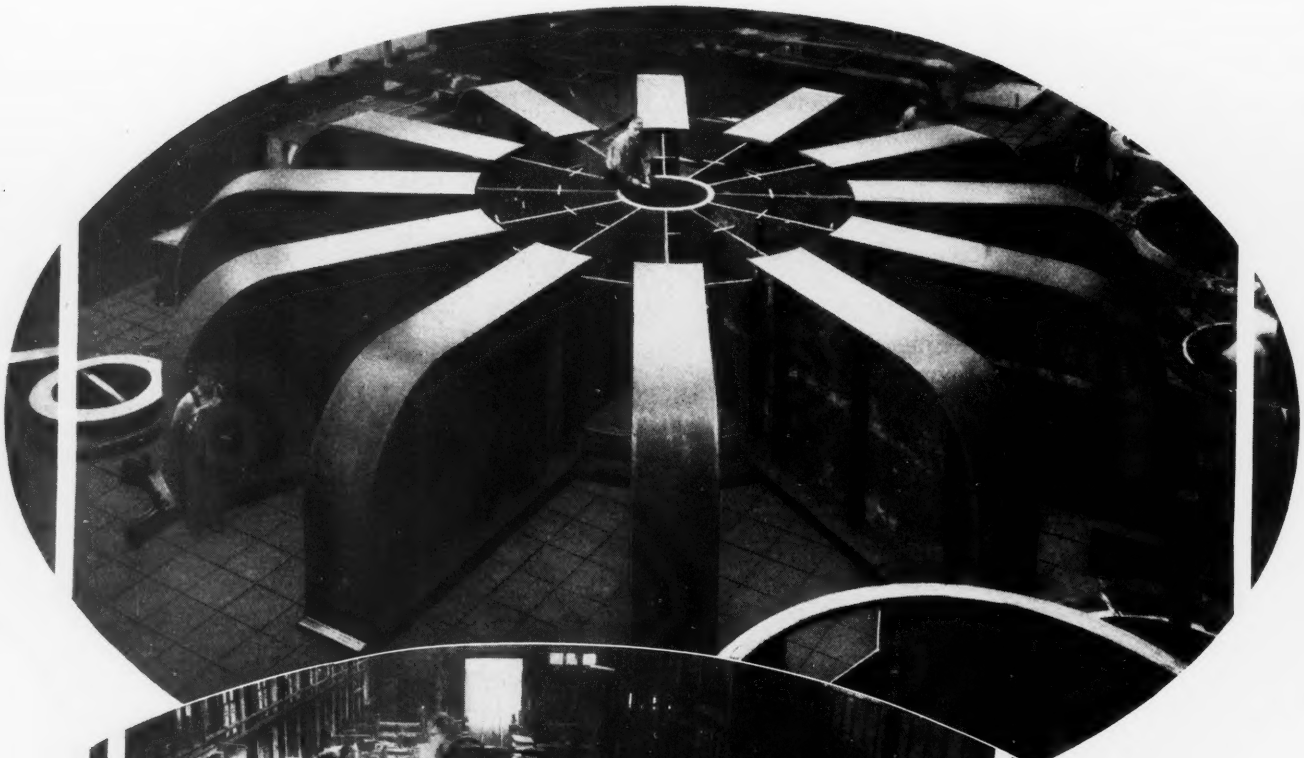
* * *

PHOTOGRAPHING PROGRESS BOARDS FOR RECORD

An interesting progress board is described in *The Automobile Engineer*. In a large plant, the progress office is centrally located within the shop and is fitted with a number of metal control boards or panels around the walls. Each board corresponds to one type of machine or model being built, and is divided into vertical columns corresponding to the different departments and operations through which the work passes. The names of the component parts and part numbers are listed on one side of the board in the usual way.

All the boards are drilled to receive colored pegs corresponding in position to the location of the work, and it is claimed that, by recording movements of work from the turned in transfer slips, the position of any part or unit within the works can be seen within half an hour of the transfer of work from one department to the next. During the dinner hour each day, all the progress boards are photographed, and large-scale prints are immediately prepared and sent to the works manager's office. Thus a permanent record of the movement of all work can be kept, and the progress of the work can be followed without difficulty.

Huge Hydro-electric Generator for Russia

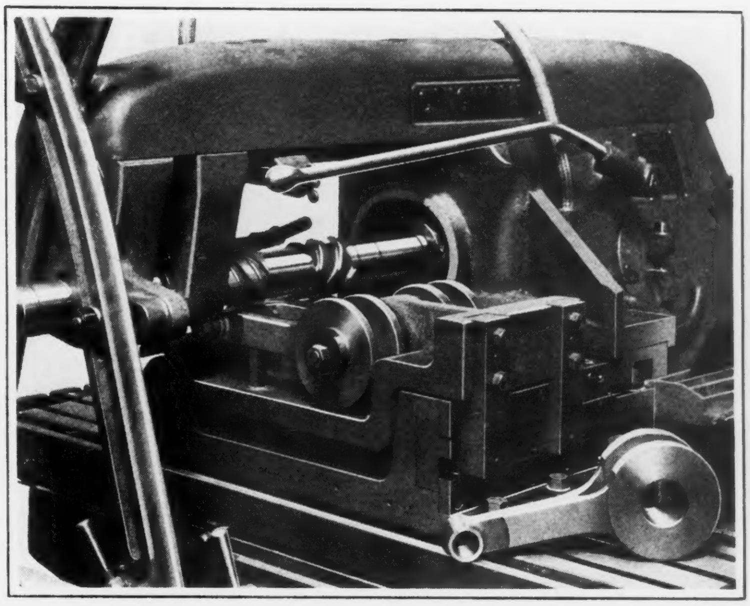


In the illustration above is shown the huge thrust - bearing bracket of an 84,000-horsepower hydro-electric generator under construction at the Schenectady Works of the General Electric Co. for the Dneiper River development in Russia.

The complete unit will have a total weight of 875 tons, the bracket alone weighing more than 117 tons.

The illustration to the left shows the immense steel plate stator frame for this huge hydro-electric machine, the largest of its kind ever built. This frame weighs 69 tons and measures 42 feet in diameter.

Milling Master Rods for Aircraft Engines



Examples of Milling Fixtures Designed to Suit the Comparatively Moderate Production Requirements of Aircraft Engine Plants

MANY of the milling fixtures used in aircraft engine plants are of simple design, because the production requirements do not warrant elaborate equipment. It is not always possible, however, to adhere to simple designs if a fairly high production is desired. To illustrate this point, a number of operations performed on the master rods of the Lycoming aircraft engine will be described. These rods, one of which is shown in Fig. 1, are made from steel forgings and are milled practically all over. The milling operations are performed on Cincinnati milling machines.

Cam-operated Fixture for Irregular Contour

The contour on both sides of these rods is milled by the use of the fixture shown in the heading illustration. This fixture is cam-operated, one end of the rod being lowered during the horizontal movement of the table so as to produce the desired contour. The cut is started at the small end of the rod and a straight surface is milled for a predetermined distance. This is followed by a change of 2 degrees in the direction of the feed until the cutter approaches the large end of the rod, where a large curvature is milled equal to that of the cutter.

The upper plate on which the work is secured is hinged at the left to the baseplate of the fixture, and is actuated by wedge cams which move in a lateral direction at the right-hand end of the fixture. These cams, in turn, are actuated by a stationary cam secured to the column of the machine. A roller, attached to the wedge cams, engages the stationary cam; and as the table travels toward the left, the wedge cams slide toward the machine column, allowing the right-hand end of the work-carrying plate to descend the amount required to produce the contour on the rod.

For each pass of the cutter two sides are milled. The same fixture is used for the finishing cut. With a table feed of 2 1/4 inches per minute, the time per piece is 5.2 minutes for roughing and the same for finishing. A total of about 1/8 inch of stock is removed from each surface.

Channel Contour Milled in Sections

The bottom of the channel at the crankpin end of the rod is at an angle with a center line passing through the rod. This part of the channel is milled in a separate operation, as shown in Fig. 2. The remainder of the channel, which continues up to a point close to the small end of the rod, is milled in a later operation. A machine of the duplex type is used for milling the first or angular part of the channel, but only one head is used.

The fixture has two pairs of plugs which enter the holes in the rods and serve as locaters. Two quick-operating clamps are used, and one set of clamps secures both rods.

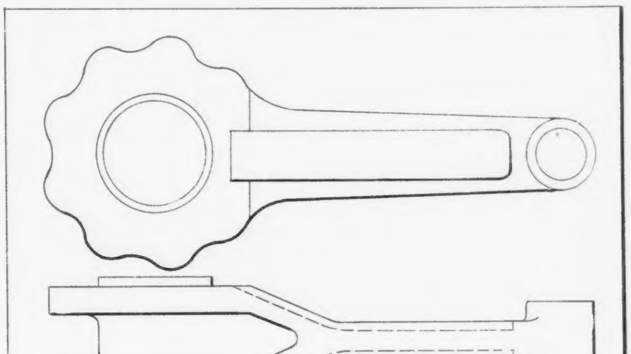


Fig. 1. Master Rod which is Milled Practically All Over

The thickness of the channel is held within close limits by means of the automatic variable feed attachment, the positive stop for the machine table, and the delayed tripping mechanism. This mechanism allows the table to move to a predetermined depth and then dwell for a few seconds while the cutter cleans up the cut. The table then automatically returns and stops. In this way, the thickness of

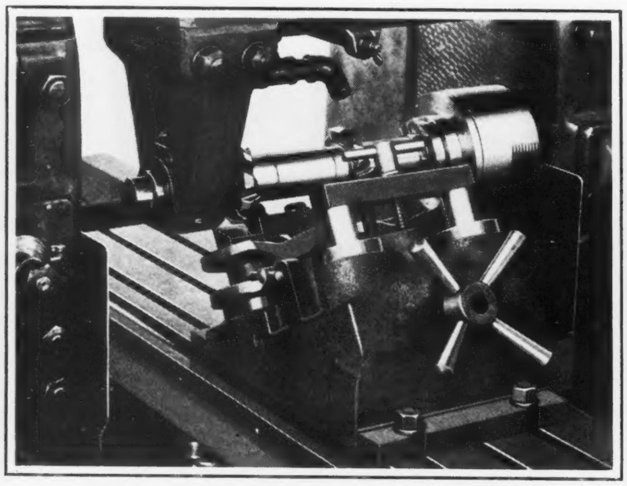


Fig. 2. Milling One End of the Channel Slot

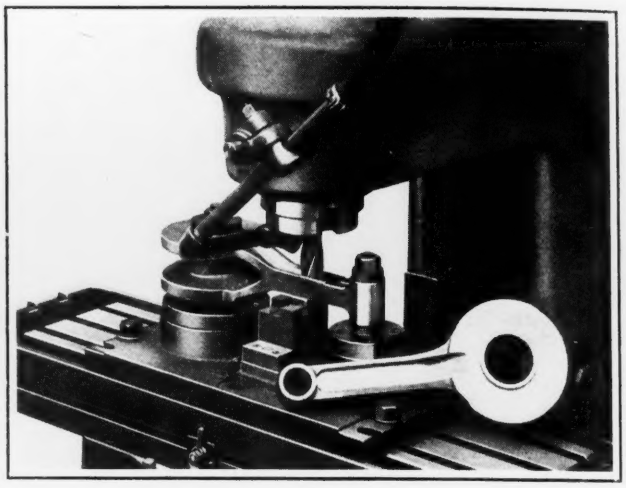


Fig. 3. End-milling the Remainder of the Slot

the channel can be easily controlled within limits of 0.001 inch. The time per piece for this operation is 2.8 minutes for roughing and the same for finishing. However, the roughing operation only is performed at this time.

Milling Channel at Small End of Rod

The section of the channel near the piston or wrist-pin end of the master rod is rough- and finish-milled on a vertical milling machine, as shown in Fig. 3. The fixture consists chiefly of a cast-iron base in which are secured two studs that fit into the wrist-pin and crank holes of the rod. The rod is clamped by C-washers and nuts on the ends of the studs, and rough-milled by an end-mill.

The piece is then finish-slotted in the set-up shown in Fig. 2, after which it is returned to the fixture shown in Fig. 3, where the wrist-pin end of the channel is finished by an end-mill. The finish cut requires that the piece be profile-milled, as the cutter must follow a rectangular path. A table feed of 1 3/8 inches is used for roughing. The time per piece is 10 minutes. For the finishing operation a table feed of 1 7/8 inches is used, and the time per piece is 20 minutes.

Swivel Fixture for Milling Irregular Contour

In milling the two edges along the top of the channels on both sides of the rod and rounding the corners of the slotted portion, the set-up shown in Fig. 4 is used. As the contour of these edges must follow closely that of the bottom of the channel, a special cam-operated fixture of the swiveling type was designed.

The work-holding unit is pivoted at the right in a cast-iron bracket which is bolted to the table. The other end of the work-holder is free to oscillate, and is guided on flat bearings of ample width to withstand the pressure of the cut. A plate cam, fixed to the column of the machine, is engaged by a roller attached to the free end of the work-holder so that as the machine table feeds toward the left, the correct profile is milled. Special form cutters are used to mill the radius along the edges as well as the flat portion.

This equipment is also used for the finish-milling operation, in which case it is only necessary to change the form mill. The feed used is 2 5/8 inches per minute. The time per piece is 9 minutes for roughing and the same for finishing; the stock removed is approximately 1/8 inch.

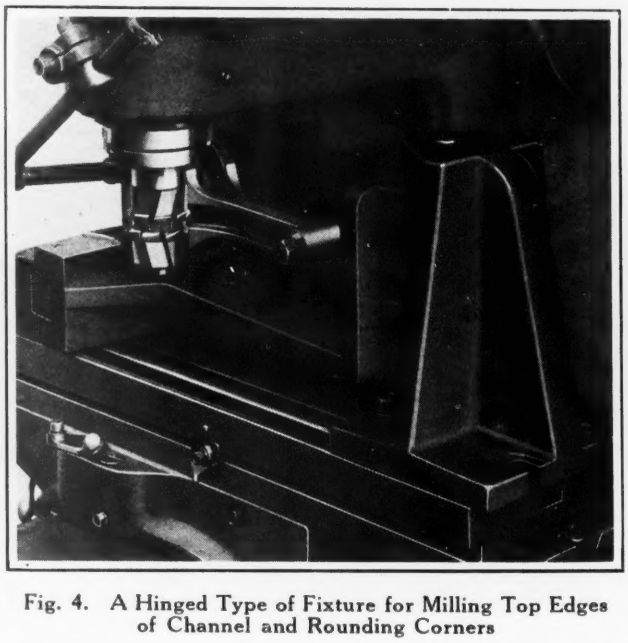


Fig. 4. A Hinged Type of Fixture for Milling Top Edges of Channel and Rounding Corners

Milling the Outside of the Wrist-pin Boss

For milling the outside of the wrist-pin bosses on either the master rod or the articulated rod, a circular attachment table is used on a vertical milling machine. As shown in Fig. 5, this circular table is secured to the machine table by bolts, and on it is placed a simple plate fixture from which project two studs that enter the holes in the rod. In the illustration, one of the "baby" rods used in the engine is shown in place instead of the master rod. The operation is the same in both cases.

The stud passing through the boss to be milled continues down through the fixture and terminates in a plug that fits the center hole in the circular table, thus locating the boss centrally. In determining the depth of cut, a 1/16-inch feeler is used between the outside diameter of the collar un-

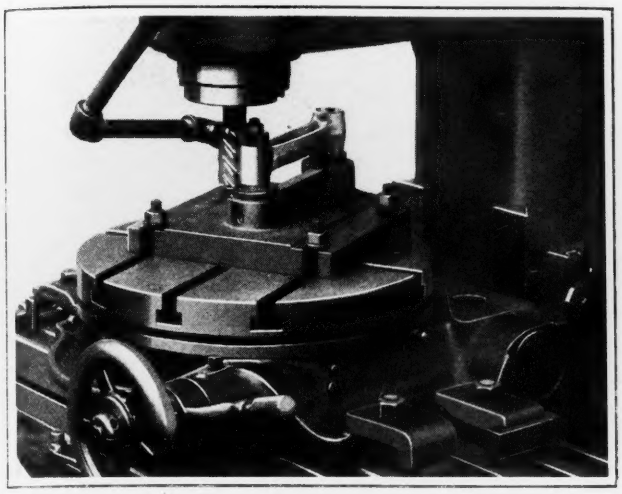


Fig. 5. Finishing the Outside of the Wrist-pin Boss

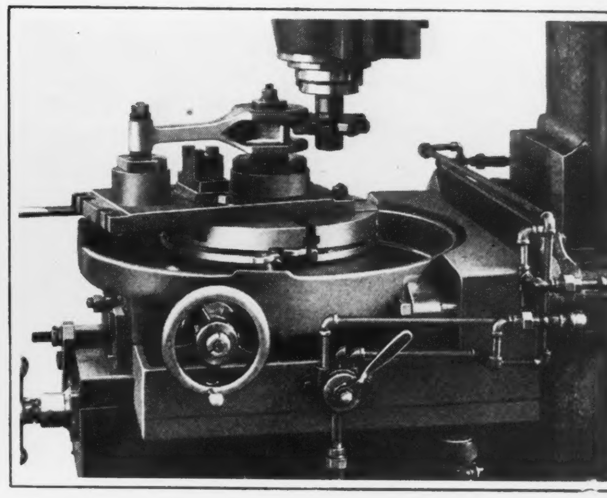


Fig. 6. Milling Between the Crankpin Flanges

der the hub of the rod and the milling cutter. The table may then be moved toward the cutter a predetermined amount as required. The circular travel of the master rod hub is controlled by dogs and stops located on one side of the table. The same set-up is used for the finish cut. The time required for milling each of these bosses is 2.2 minutes.

Rotary Table Simplifies Fixture Design

In Fig. 6 is shown a set-up for milling between the flanges at the crankpin end of the rod. A vertical milling machine equipped with a power-feed rotary table built for heavy circular milling is employed for this job. The saddle of the machine is locked to the knee, as only the rotary feed of the circular table is used.

The fixture is located in the center hole of the circular table by means of a plug which is concentric with the hole in the large end of the rod. A cutter somewhat wider than half the distance between the flanges is used for roughing the recess, only half the bottom and one side being milled at each partial rotation of the table. In the finishing operation, however, an interlocking slotting cutter the full width of the recess is used, thus producing a smooth unbroken surface.

Dogs automatically control the movement of the circular table, stopping it at the end of the cut. This not only reduces idle time but also prevents spoiled work which often results when the circular feed is operated manually. The time per piece is 13.9 minutes for roughing, and 7 minutes for finishing.

Incidentally, it may be noted that the fixture employed for this job is used for numerous operations on the master rod. For instance, it is used for the rough- and finish-milling operation shown in Fig. 3.

Milling Bosses for "Baby" Rods

One of the final milling operations on the master rod consists of milling the contour of the crankpin end to form the bosses for the "baby" rods. This operation is illustrated in Fig. 7 and is performed with the same machine equipment as shown in Fig. 6. However, special means are provided for giving the rotary table a reciprocating movement. This movement is produced by a master cam and roller arrangement.

The master cam is secured on the top of the circular table, and it is held against a roller, pivoted in a bracket bolted to a special auxiliary saddle, by means of air cylinders mounted on the auxiliary saddle. Thus, the flanges of the rods are milled to the proper profile through the action of the cam and roller, which moves the circular table in and out as required.

The entire mechanism is contained in the auxiliary saddle on the machine knee. This allows the mechanism to be moved away from the cutter to facilitate the removal of work. Also, the mechanism can be set to a positive stop to obtain the proper depth of cut, after which the auxiliary saddle can be locked in position and the rotary feed engaged to produce the cam profile.

Because of the unusual amount of thrust against the end-mill in this operation, a support is

Fig. 7. The Circular Bosses on the Flanges are Milled by Using a Table with a Reciprocating Movement Produced by Cam Action

provided at its lower end. This support consists of a bracket secured to the column, in which an extension at the lower end of the mill is a running fit. The bracket, as well as the fixture and its actuating mechanism, can be removed from the machine so that the latter may be used for other work. The time required per piece on this operation is 18.2 minutes for roughing and the same for finishing.

All the rough-milling operations on the master rods are done on rough forgings which have been previously rough-turned, rough-bored, and rough-reamed. After rough-milling, the rod is heat-treated, finish-turned, finish-bored, and finish-reamed. It is then finish-milled. The fixtures described in the foregoing, therefore, have interchangeable locating studs, so that the rods can be located from either rough-reamed or finish-reamed holes.

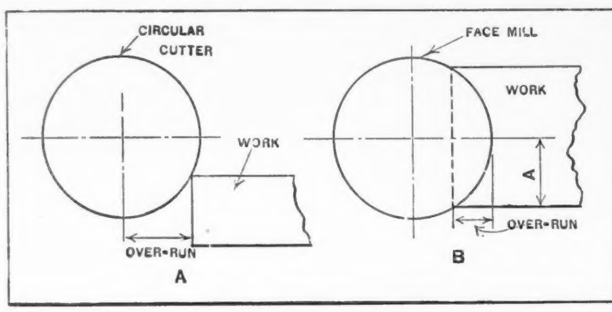
* * *

The exports of machinery and metal products from Switzerland reach considerable proportions, considering the small size of the country. In 1929, the exports of these products amounted to over $100,000,000 in value, while the exports of watches and watch parts reached a value of more than $60,000,000.

TABLE GIVING OVER-RUN OF MILLING CUTTERS

By R. H. KASPER

Whenever a cut is taken on a milling machine, there is a certain portion of the table travel during which the cutter is not operating at full efficiency. This is due to the fact that the cut starts from zero depth and gradually increases until the full depth is reached. This distance, commonly called the over-run of the cutter, applies to both circular cutters and face mills, as indicated in the diagrams *A* and *B*.



Diagrams Indicating Over-run of Circular and Face Milling Cutters

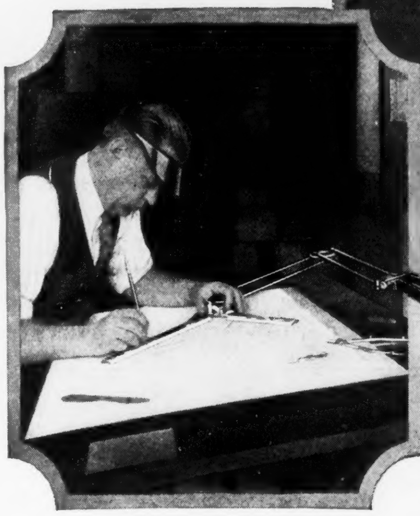
In estimating the time of milling operations, the over-run must be added to the effective length of cut.

Given the diameter of the cutter and the depth of cut, the over-run can be determined from the accompanying table. For face-milling, where the swing of the cutter passes entirely across the work, one-half the width of the work surface is taken as the depth of cut. This is indicated by *A* in diagram *B*. Although the figures in the table are given in decimals of an inch, it is seldom, if ever, necessary to work closer than the nearest fractional part of an inch. If, for purposes of finish, it should be necessary to pass the cutter entirely through the work, the over-run given in the table must be doubled.

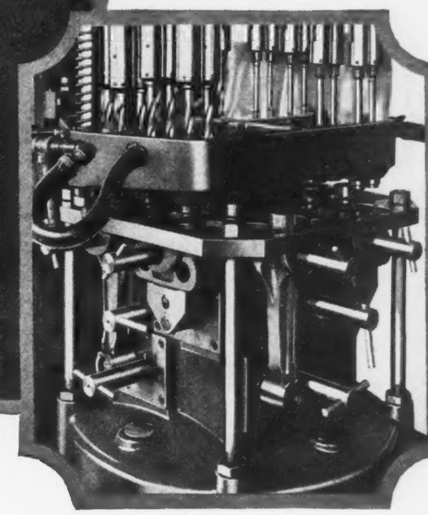
Table Giving Distance Milling Machine Table Travels at Beginning of Cut Before Cutter Operates at Full Efficiency

Depth of Cut, Inches	Diameter of Cutter, Inches													
	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	7	8	9	10	12	15
	Over-run of Milling Cutter, Inches (See Illustrations)													
1/4	0.75	0.82	0.90	0.96	1.03	1.08	1.14	1.19	1.29	1.38	1.44	1.56	1.71	1.92
1/2	1.00	1.11	1.22	1.32	1.41	1.50	1.22	1.65	1.80	1.93	2.06	2.17	2.39	2.69
3/4	1.14	1.29	1.43	1.56	1.67	1.78	1.88	1.98	2.16	2.33	2.48	2.63	2.90	3.23
1	1.22	1.41	1.58	1.73	1.87	2.00	2.12	2.23	2.44	2.64	2.82	3.00	3.31	3.74
1 1/4	1.25	1.47	1.67	1.85	2.01	2.16	2.30	2.43	2.68	2.90	3.09	3.30	3.66	4.18
1 1/2		1.50	1.73	1.93	2.12	2.29	2.44	2.59	2.87	3.12	3.35	3.57	3.96	4.50
1 3/4			1.75	1.98	2.19	2.38	2.56	2.72	3.03	3.30	3.56	3.79	4.23	4.81
2				2.00	2.23	2.44	2.64	2.82	3.16	3.46	3.74	4.00	4.47	5.09
2 1/4					2.25	2.48	2.70	2.90	3.26	3.59	3.89	4.17	4.68	5.35
2 1/2						2.50	2.73	2.95	3.35	3.70	4.03	4.33	4.89	5.59
2 3/4							2.75	2.98	3.41	3.79	4.14	4.46	5.04	5.80
3								3.00	3.46	3.87	4.24	4.58	5.19	6.00
3 1/4									3.49	3.92	4.32	4.68	5.33	6.18
3 1/2									3.50	3.96	4.38	4.76	5.45	6.34
3 3/4										3.99	4.43	4.84	5.56	6.49
4										4.00	4.47	4.89	5.65	6.63
4 1/4											4.49	4.94	5.73	6.75
4 1/2											4.50	4.97	5.80	6.87
4 3/4												4.99	5.88	6.97
5												5.00	5.91	7.07
5 1/4													5.95	7.15
5 1/2													5.97	7.22
5 3/4													5.99	7.28
6													6.00	7.34

*See article for application to face milling cutters.



Design of Tools and Fixtures



MULTIPLE DRILL HEAD OF INTERCHANGEABLE DESIGN

By JOHN G. JERGENS, Cleveland, Ohio

In some plants, multiple drill heads are used extensively for various classes of work; these are usually of the unit type, necessitating a different head for each lay-out of holes to be drilled. With the design shown in the illustration, however, the main part of the head serves for numerous hole lay-outs. All that is necessary is to choose the chuck-spindle carrier that corresponds with the proper hole lay-out and mount it on the body.

The body, which is shown at *A*, is split at one end so that it can be clamped on the spindle quill of the machine. At the other end is fastened the chuck-spindle carrier *E*. This carrier forms the bearing for all the chuck spindles as well as for the end of the driving gear shaft *J*.

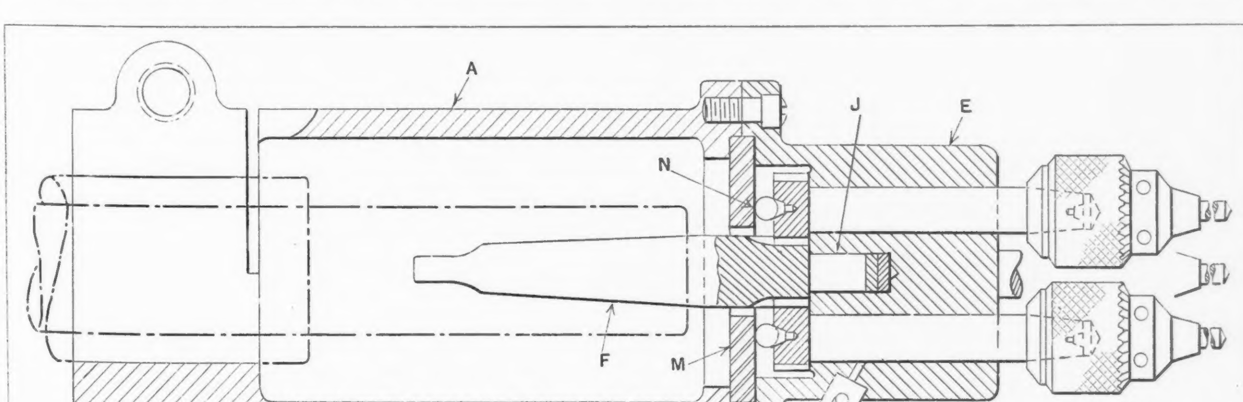
The thrust of the drilling is transmitted to a hardened steel plate *M* through the balls *N* which seat themselves in countersunk holes in the end of each pinion spindle. Although scroll chucks are shown on these spindles, chucks of the type shown at *Y* may be used in cases where the holes are to be drilled very close together.

It is obvious that when it is desired to drill holes having different lay-outs, all that is required is to remove the chuck-spindle carrier *E* and replace it by another corresponding to the required hole lay-out. The thrust plate *M* is made sufficiently large to take in a wide range of hole lay-outs so that the balls in each pinion shaft will rest against it. The pinion gear diameters should be designed so that the member *F* may be used for the entire range of spindle carriers.

DIE FOR PIERCING OPPOSITE HOLES SIMULTANEOUSLY

By GEORGE H. PICKHARD, Newark, N. J.

The die here illustrated is designed to enable holes to be punched through opposite sides of a channel iron simultaneously. This type of die can be adapted to piercing box-shaped parts, tanks, or



Drill Head in which Chuck-spindle Holders are Interchangeable

any article in which holes are required on opposite sides. It may be mentioned, however, that this die is especially suitable for light work, as the friction resulting from the cams used would prohibit its use on work of a heavy nature.

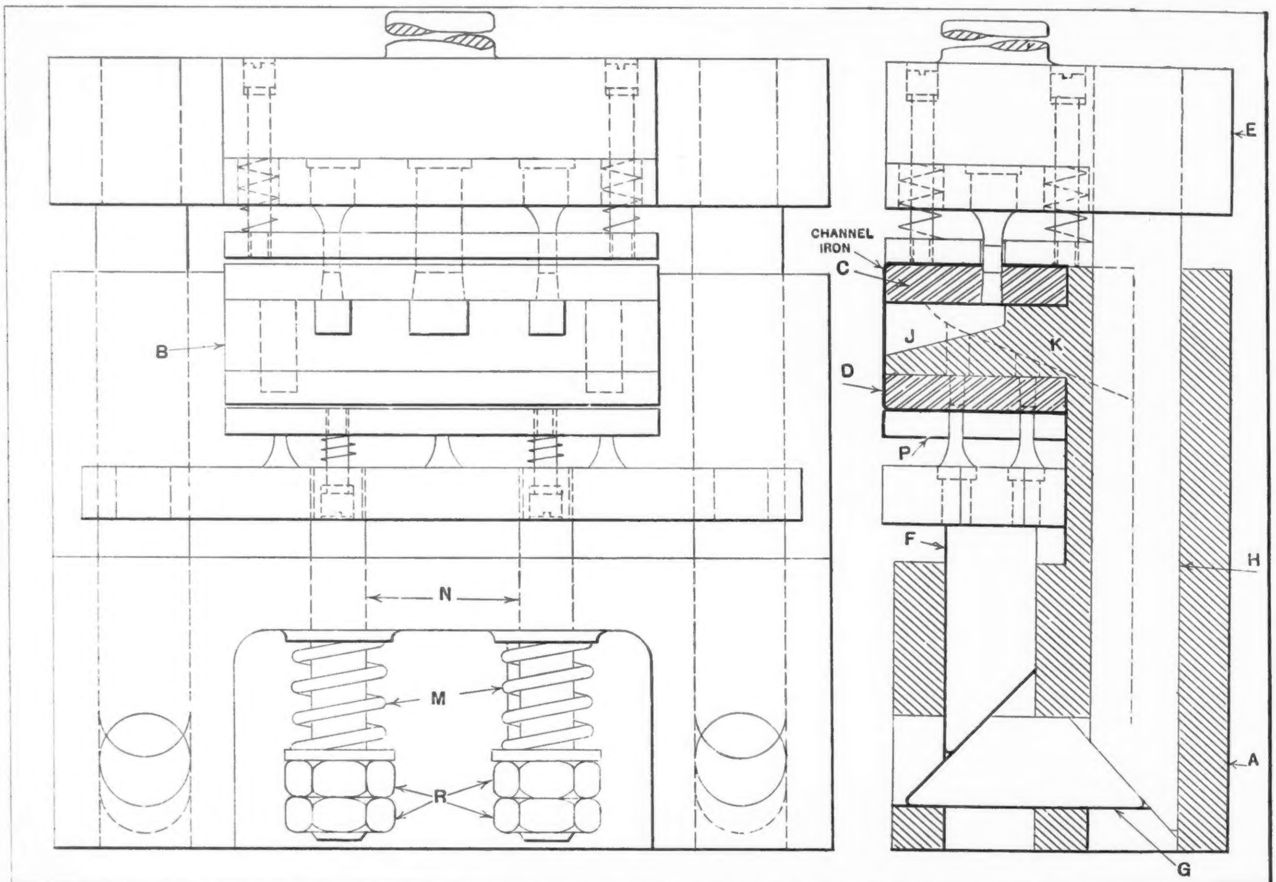
In operation, the work, shown in heavy lines, is placed over the projection *B* of the die-bed *A*. On the top and bottom of this projection are secured the dies *C* and *D*. One set of piercing punches is held in the punch-block *E* and is provided with a spring-actuated stripper plate, which is fastened to the punch-block by fillister-head screws.

The punches for piercing the opposite side of the channel are secured to the sliding member *F*. Vertical movement is transmitted to this member by the cams *G* and *H*. The upper end of cam *H* is securely fastened in the punch-block, while the lower end is beveled and engages cam *G*.

As the punch-block descends, the lower end of cam *H* forces cam *G* to the left. Cam *G*, in turn, engages the cam end on member *F*, thus raising the latter and forcing the lower punches through the channel. In the meantime, the punches in the upper block have entered the opposite side of the channel. Clearance holes are provided in dies *C* and *D*, and in the projection *B*, for both the upper and lower punches. These holes run into slots *J* and *K*, thus providing a passageway for the escape of the piercings.

When the punch-block ascends, the member *F* is returned to its lowest position by the two springs *M* on the studs *N*, which are screwed into the member *F*. A spring-actuated stripper plate *P* is provided for the punches in member *F*. Thus it will be obvious that the piercing conditions are the same for both sides of the channel.

All cams used in this die are hardened and ground. The check-nuts *R* on the ends of studs *N* provide for adjusting the pressure between the angular faces of the cams. This pressure should not be greater than is necessary to carry the member *F* to its lowest position. In designing a die of this type, it is advisable to have the bottom punch-holder do the lightest operation, as it is obvious that the power required to force the punches through the work is considerably increased by the frictional resistance of the cam surfaces.



Cam-operated Die in which Opposite Sides of Channel Iron are Pierced

This design of die is best adapted for use in a horn press, because of the greater shut height obtainable with this type of press. Although the die shown performs piercing operations only, it is possible to adapt the design to forming, embossing, and other operations performed opposite each other.

ASSEMBLING RADIATION FINS ON HEATER TUBING

By P. H. WHITE, St. Louis, Mo.

In a certain type of steam-heating radiator, seamless copper tubes are employed for radiating the heat. To increase the heating capacity of the radi-

ator, thin brass fins are pressed over the outside of the tubes, thus increasing the heated area. At *E* in Fig. 2 is shown a section of the tubes, and at *F* one of the fins, while a tube with the fins assembled in place is shown at *G*. The die for making these fins was described in the October number of MACHINERY, page 115.

The machine for assembling the fins on the tubes is illustrated in Fig. 1. It consists chiefly of a spacing holder *A* in which the fins are held with spacers between them, and an air cylinder *J* which furnishes the power for pressing the tubes through the fins. The construction of the holder may be readily understood by referring to Fig. 2, which the fins, so that they are completely surrounded and held at the exact spacing required. The tubes are made ready by cutting them to the required length, removing all burrs at the ends, and inserting the pilot shown at *H*. The shape of the pilot somewhat resembles an arrow, with the largest part of the head slightly smaller than the outside of the tube. It will be noticed that the head is cut down at *P* to fit the inside of the tube and center it in relation to the fins.

The shank of the pilot is slightly longer than the tube, its end resting against a spring plunger in the end of the air cylinder ram. With one end of the tube resting against the shoulder of the pilot head,

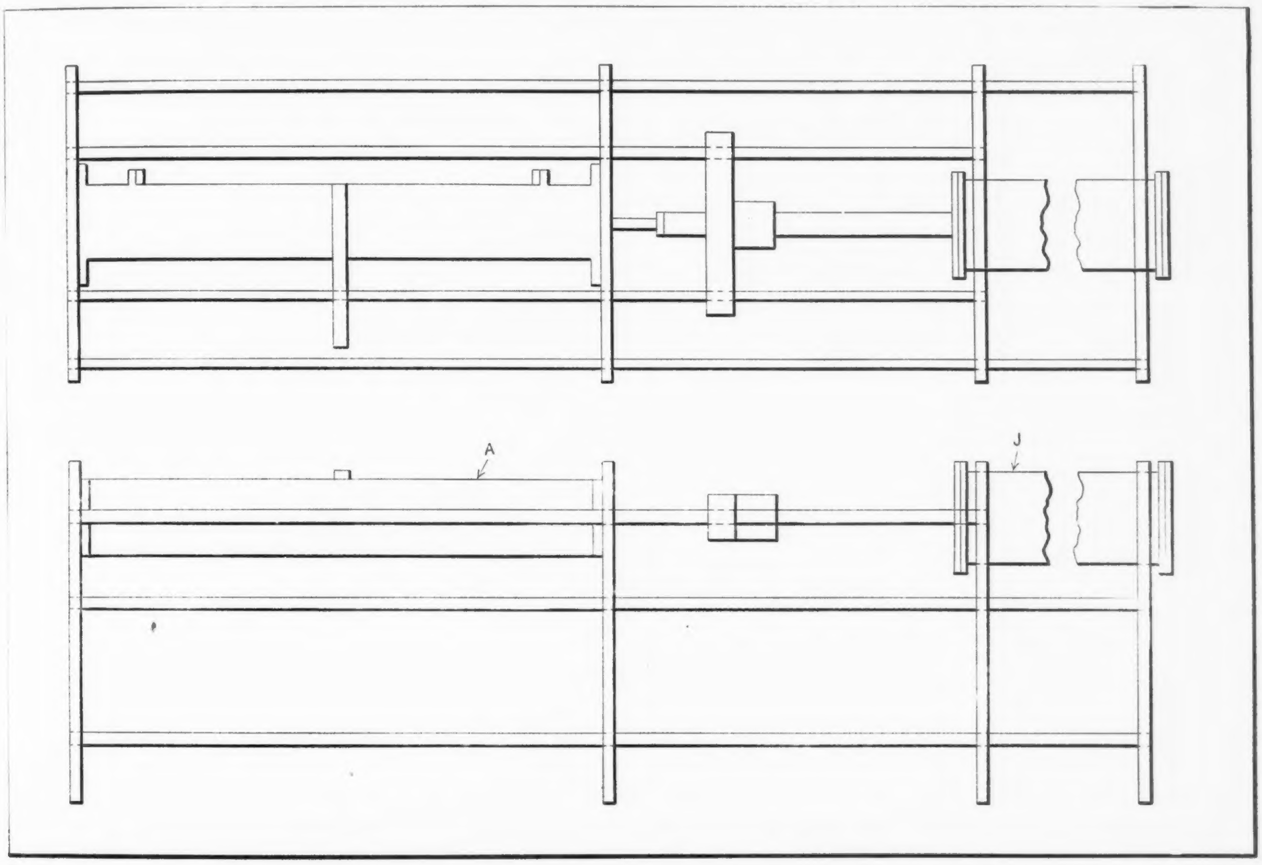


Fig. 1. Machine in which Fins are Assembled Pneumatically on Radiator Tubes

shows at *A* and *B* a longitudinal- and a cross-section of part of the holder with the spacers *C* and *D* secured in the members *K* and *L*.

These spacers, which are made of cold-rolled steel, have the same outside dimensions, but have different sized V-notches cut in them. Part *C* is a few gages heavier than the fin, while part *D* is equal in thickness to the spacing required between the fins. The holder *A* into which the spacers are assembled is made of channel sections in two halves which are hinged together. Since the open spaces in the upper and lower halves must line up accurately in order to close properly over the fins, great care must be taken in assembling the spacers in the holder.

To load the die, the upper half is swung open and the slots in the lower half are filled with the fins. The upper half is now swung down over the top of a collar on the plunger is slipped over the shank, in contact with the other end of the tube. In this position, a screw in the collar is tightened against the spring plunger. With this arrangement, the greater part of the thrust is taken by the pilot rather than by the tube.

With the pilot and tube assembled as described, the air valve is opened slightly to bring the end of the pilot up to the opening in the holder. The valve is now opened wide, and the ram moves forward, forcing the tube through the fins. As there is considerable clearance around the fins, they must be centered ahead of the advancing tube. This is done by the pilot, which picks them up on its pointed end and brings them into the exact position to receive the tube. When the holder is opened, the tube, with the fins assembled, is lifted out and the pilot removed.

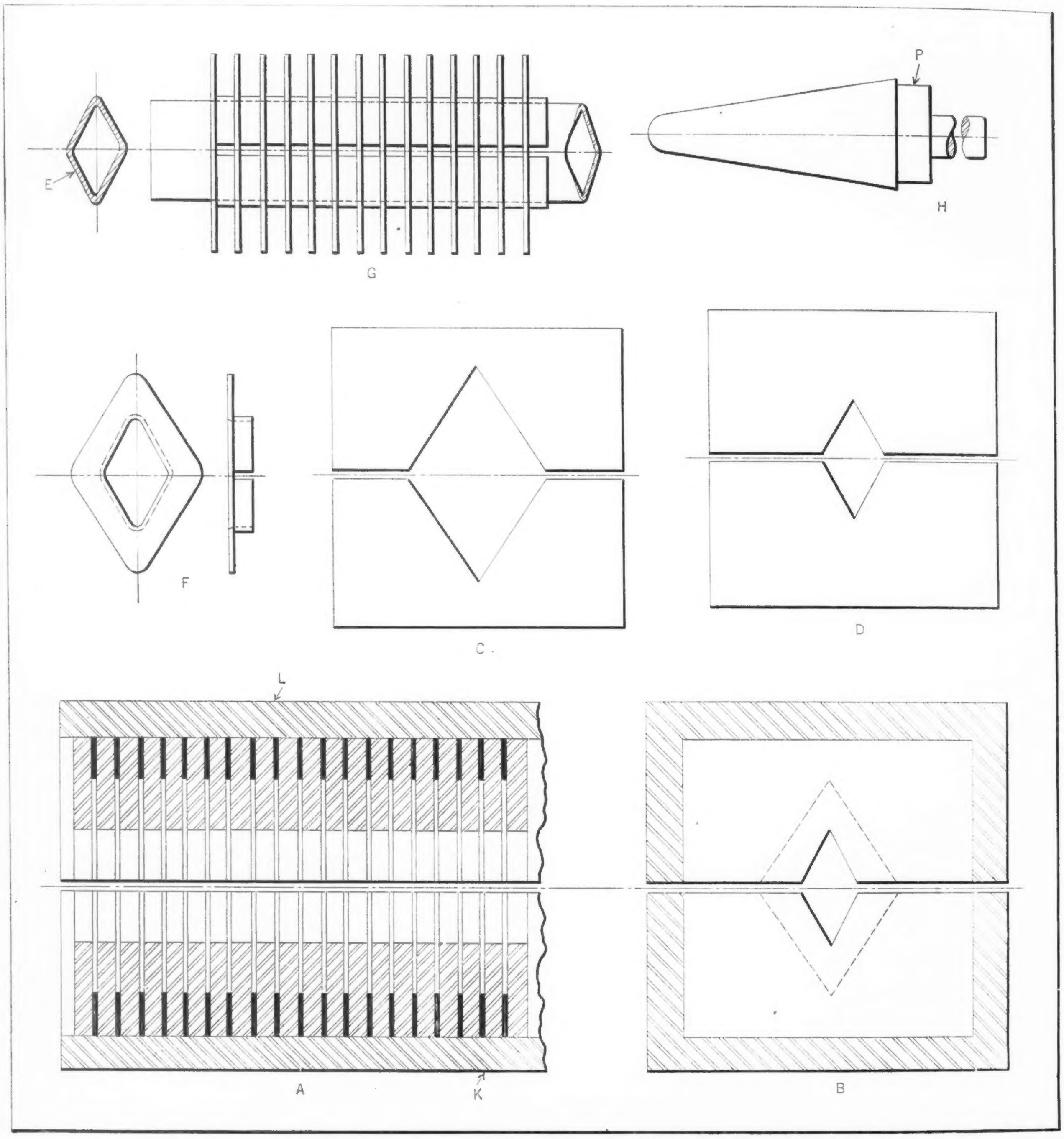


Fig. 2. Assembled Tube, and Details of Machine Shown in Fig. 1

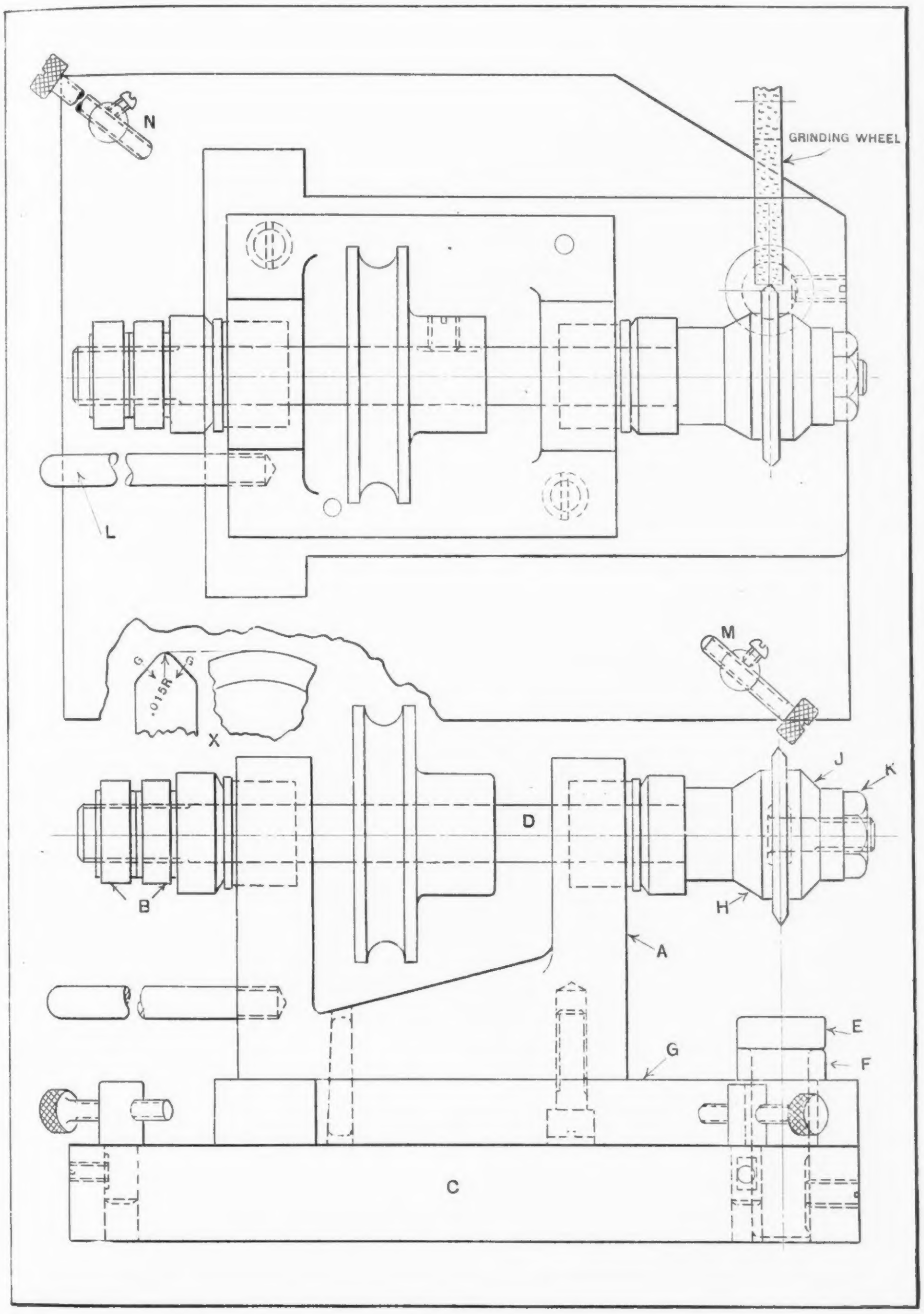
The tube is then dipped into a tinning solution which forms a complete bond between the tube and the fins. The final step consists in inserting the ends of the tubes into headers, brazing them in place, and testing for leaks.

FIXTURE FOR GRINDING CIRCULAR ARCS AND ANGLES

By J. ABBAZIA, Mechanical Instructor, Yale & Towne Mfg. Co., Stamford, Conn.

The swivel fixture here illustrated is used on a surface or cylindrical grinding machine for grinding circular arcs and angles without resetting the work. In this case, a disk—a portion of which is shown at *X*—is held securely on the end of the spindle *H* by means of the washer *J* and the nut *K*. The spindle is driven by a round belt from an overhead countershaft, and is mounted in roller bearings in the head *A*.

Check-nuts *B* provide the necessary adjustment for preventing end play of the spindle. The head *A* is fastened by screws to the flat plate *G* and swivels about the plug *E*, which is a slip fit in the bushing *F* and is secured in the plate *C* by means of a set-screw. The center of this plug is so located that it will be directly under the center of the arc to be ground. The screws *M* and *N* serve as stops for limiting the angular movement of the head, and may be adjusted to stop the head at the correct angle.



Fixture in which Two Angles and a Circular Arc are Ground in One Setting

To grind the disk, the operator grasps the handle *L* and swings it until the edge of the plate *G* comes in contact with the stop *N*. The table of the machine is then fed longitudinally, and the angle at the left is ground as the rotating disk passes the grinding wheel. The head is next swung around until the plate *G* comes in contact with the stop *M*, after which the other angle is ground in the same manner.

The arc is now ground by swinging the head between the two stops while the grinding wheel is in contact with the work. Arcs of various radii may be ground on this fixture by using interchangeable bushings *F*, bored eccentrically and arranged so they will not rotate in the plate. The rotation of the bushings is prevented by machining a flat on one side which is engaged by the set-screw shown.

HOW TO MAKE CHAIN DRIVES LAST LONGER

In answering the question "How can chain drives be made to last longer?" Charles R. Weiss, chief engineer of the Link-Belt Co., Indianapolis, Ind., says that there are five simple things to do:

1. The sprocket wheels must be in proper alignment. If they are not, there will be a side pull which concentrates the load on the side of the sprocket teeth and on one side of the chain. This causes excessive wear on both chain and sprockets.

2. The chain must be properly adjusted. It should run just a little slacker than a belt; too much tension causes undue wear on the chain and friction on the bearings. Not enough tension, however, may cause the chain to jump the sprockets or ride the teeth and break.

3. Frequent lubrication of the chain is important. A good grade of light cylinder oil should be used. A paint brush is suitable for applying the oil to the chain joints. Paint the open-joint chain on the open (upper) side. Oil the closed-joint chain on the inside (upper side of lower run) while the drive is running slowly.

4. Frequent cleaning of exposed drives is important. Take off the chain and clean it well by dipping and soaking it in kerosene. Then dry it thoroughly and oil it well before starting the drive. Before shutting down the machine for a period of time, clean the chain and oil it with heavy oil or grease. When it is to be used again, clean it and oil it with light oil.

5. Well fitting sprockets are important. Examine the sprocket wheels from time to time to make sure that they are not worn enough to injure the chain. As soon as the teeth show a tendency to wear to a hook shape, the sprocket wheels should be replaced with accurately made and close fitting sprockets.

By paying attention to these rules, chain drives can be made to last much longer, they will run better, and the chances of breakdowns will be less. Briefly, the cost of chain drives will be materially reduced.

The Fundamentals of Machine Polishing*

A Review of Typical Polishing Machines that Have Been Found Applicable to a Varied Line of Polishing Operations

By ROBERT T. KENT, Director of Engineering, Divine Bros. Co., Utica, N. Y.

IN October MACHINERY, page 129, the importance of the proper selection of polishing wheels and abrasives, as well as the care of polishing wheels, was dealt with. The present article will discuss the elimination of vibration, methods employed for holding work for machine polishing, and types of polishing machines.

Vibration of Machine or Work Should be Eliminated

Vibration causes the polishing wheel to produce chatter marks on the work. The high speeds at which polishing wheels are operated cause vibration to be set up more easily than in machinery operated at lower speeds.

The more common causes of vibration are inadequate machine foundations; improperly or lightly constructed buildings; light floors; machines improperly located on upper floors; insufficient weight in machine bases; shafts too light or with bearings too far apart, giving them a tendency to whip at high speeds; insufficient bearing surface; improperly braced machine members or members whose vibration period corresponds to some recurrent motion in some moving part of the machine; and unbalanced polishing wheels.

Vibration may also be caused by improper seating of the work in the fixtures. Although vibration from this cause is usually confined to the work itself, the machine should be sufficiently heavy to absorb it. The effect of such vibration on the work may be just as serious as that of vibration in the machine itself.

Too much cushioning may also tend to set up vibration in the polishing wheel, as was the case in polishing automobile bumpers where the bumpers themselves furnished a particularly resilient cushion. In this case, the cushioning effect was lessened by placing supports at two or three points under the bumper and attaching dashpots to each wheel-spindle to dampen vibration.

Properly designed fixtures are essential to success in machine polishing. They must hold the work firmly, pressing it against the polishing wheels in the correct position, and in some cases, providing a certain amount of resiliency and automatic adjustment of the work to the wheel. Most important of all, they must hold the work so that it cannot be dislodged when it comes in contact with the wheels. One should bear in mind that it is about as safe to stand in the path of a rifle bullet as to stand in the path of a piece of work thrown out of a fixture by the polishing wheel. Many jobs cannot be handled on a polishing machine, because it is impossible to hold them safely in any practical type of fixture.

Fixtures employed on polishing machines must be designed for quick and easy loading and unloading. In some cases, a detachable fixture may be used which is loaded at the bench and transferred to the machine. Such fixtures should be light, yet rigid. All fixtures should have provision for compensating for wear. The fixture should be so made that it can be placed on the machine in one position only. In several cases, serious accidents have occurred through the neglect of this simple precaution.

For flat work, such as ornamental plates, and spherical or similar shaped work that cannot be held in the ordinary type of mechanical chuck, it may be possible to employ a chuck of the vacuum type. For castings made of steel or iron, the mag-

*Abstract of a paper presented at the National Meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers in Chicago, September 23-24.

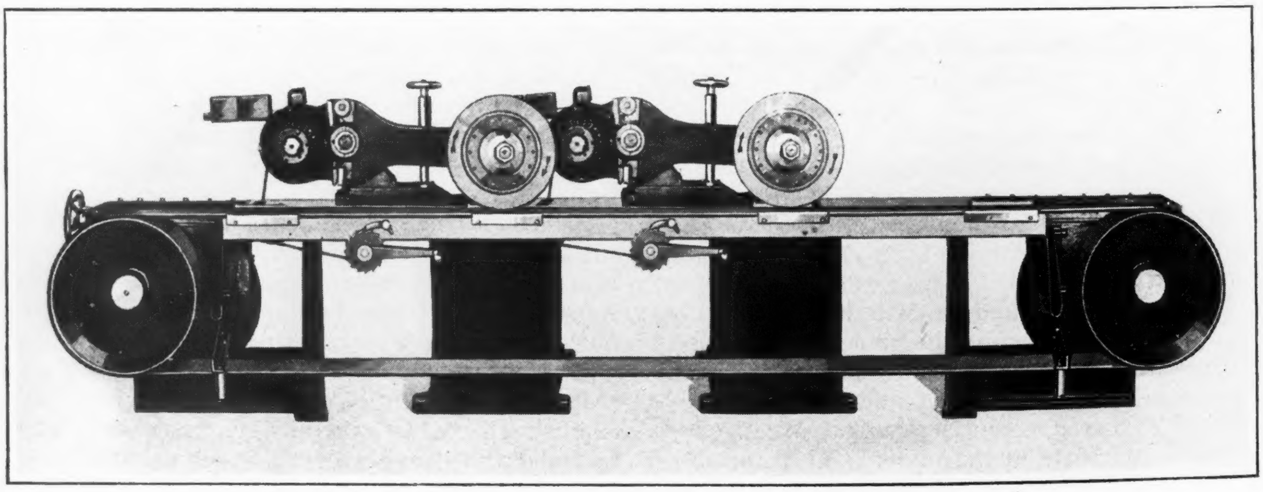


Fig. 1. Continuous Straight-line Polishing Machine Equipped with Two Wheels

netic chuck is sometimes used. The best method of handling flat strips or sheets is to employ pressure rolls on each side of the polishing wheel in place of fixtures.

Examples of Typical Polishing Machines

Polishing machines may be divided roughly into two classes—those that rotate the work in contact with the polishing wheel, and those that carry it in a straight line past the wheels. Machines for finishing the heads of bolts and other parts that have a long stem, may consist essentially of a drum containing a number of chucks which rotate about their own axis while the drum itself is rotated about an axis parallel to the polishing wheel. Such work as hub caps may be carried on chucks mounted on spindles projecting from a faceplate which is indexed at definite predetermined intervals, thus allowing the work to remain in contact with the polishing wheel a sufficient length of time to obtain the desired finish. Each spindle is rotated about its axis as it comes in contact with the polishing wheel. Machines of this type are frequently provided with chucks which automatically eject the work when the spindle is in its lowest position.

Long cylindrical work may be mounted on a chuck supported at the outer end by an overhanging arm, and rotated against the wheel. At the same time, the spindle is reciprocated so that the polishing wheels cover the entire cylindrical surface.

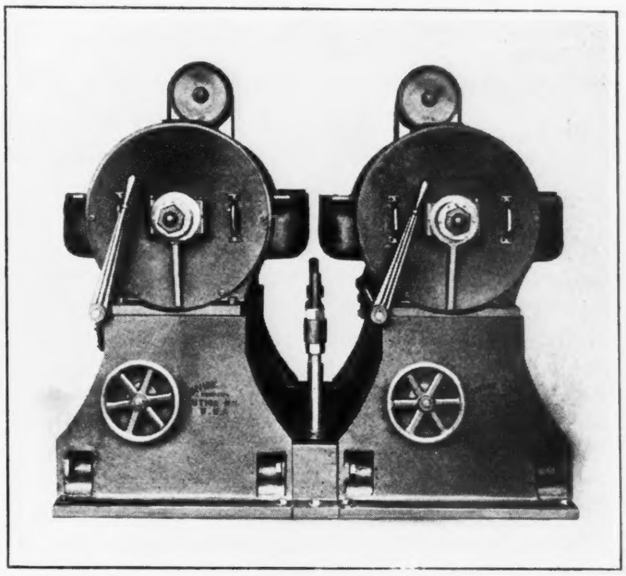


Fig. 2. Double-wheel Machine for Polishing Strip Brass Fed from a Roll

For finishing tubes or other long cylindrical objects, the work may be carried on two longitudinal rollers and moved past the polishing wheels by belts immediately behind the rollers, which are set at an angle to correspond with the speed of longitudinal movement desired. The polishing wheel is set immediately opposite the belt, which acts as a brake to prevent the work from rotating at the same speed as the polishing wheel.

In Fig. 1 is shown a continuous straight-line polishing machine. The motor of each of the two units is mounted on the opposite side of the swinging arm from the polishing wheel and drives the wheel by means of a Texrope drive. The base of each unit forms an oil tank in which there is a large float that nearly fills the tank.

A heavy rod projecting through the base terminates in a ball-and-socket joint underneath the center line of the wheel-spindle. The float is adjusted so that it supports the entire weight of the wheel and swinging arm, thus bringing the pressure on the work to zero. Any desired working pressure is then secured by a simple shifting of the weights on the wheel-supporting arm. The float also acts as a dashpot to dampen vibration of the polishing wheels. The wheels can be set at an angle to the work if so desired, the entire head being capable of swinging about the supporting rod on the float.

In polishing metal up to 50 inches wide, a conveyor belt type of machine is used. The conveyor belt carries the metal under the wide polishing wheel. Rolls on each side of the wheel exert sufficient pressure on the work to furnish the necessary traction between the belt and the sheet metal. These rolls also hold the work in position while it passes under the polishing wheel.

A machine for finishing strip brass is shown in Fig. 2. The polishing wheels are mounted on the spindles projecting through the large drum-shaped structure at the top of the machine. Each wheel is driven by a 40-horsepower motor through a Texrope drive, and oscillation is provided on each wheel-spindle. The oscillator is driven from the Texrope drive shown projecting from the top of the machine. The brass strip is fed from a coil and passes over the pressure roll underneath each polishing wheel. It is coiled by means of a friction winding device at the opposite end of the machine. These coiling devices are not shown in the illustration. The two handles projecting upward operate a quick release for the pressure rolls to permit dropping the work out of contact with the polishing wheels if for any reason it is necessary to do so without stopping the machine. The two handwheels at the front are for raising or lowering the pressure rolls to provide variations in the pressure of the wheel on the work and also to compensate for wear of the wheels.

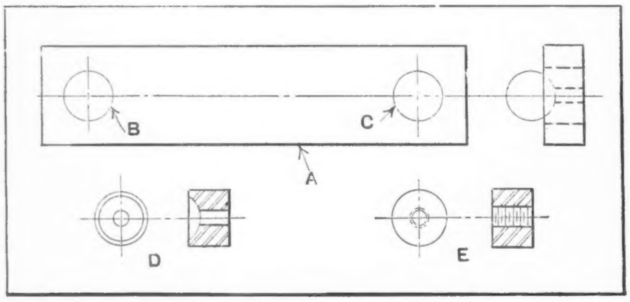
* * *

THE NATIONAL METAL EXPOSITION IN 1931

Announcement has been made by the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio, that the 1931 National Metal Exposition will be held during the week beginning September 26 on the Commonwealth Pier at Boston, Mass. The annual meeting of the Society will be held in conjunction with the exposition; the headquarters will be at the Hotel Statler. The 1924 exposition sponsored by the Society was held in Boston—at that time also on the Commonwealth Pier—and will be remembered as an unusually attractive display.

Ideas for the Shop and Drafting-room

Time- and Labor-saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



Sine Bar with Steel Balls in Place of Buttons

SINE BAR OF UNIQUE CONSTRUCTION

A practical sine bar that can be easily made is shown in the illustration. It consists of a bar *A*, two hardened steel balls *B* and *C*, and two soft steel plugs *D* and *E*. The bar *A* is a piece of machine steel. After the holes are bored and reamed at each end of this piece, it is pack-hardened. The next step is to make the two soft steel plugs *D* and *E*. These plugs are made a tight press fit in the holes in bar *A*. A spherical seat is machined in one end of plug *D* to receive the hardened steel ball *B*. Plug *E* is drilled and tapped to receive a screw such as is used for holding toolmakers' buttons in place. The two plugs are forced into the holes in bar *A*, which is then ground all over.

The hardened ball *B* is next secured to the plug *D* by soldering, after which a toolmakers' button is accurately located on plug *E*. The bar is then clamped to the faceplate of the lathe, lining up the toolmakers' button with the center of the lathe spindle in the usual manner by means of an indicator. When the work is lined up so that the button runs true, the screw that holds the button in place is removed and a spherical seat turned in the plug *E* to receive the ball *C*, which is soldered in place. This completes the job, with the exception of grinding the edges of bar *A* so that they are parallel with a line passing through the centers of the two steel balls.

A sine bar that has been carefully made in the manner described will be found accurate and convenient to set up, especially in tool-rooms equipped with accurate parallels and height blocks. One precaution must be observed, however, and that is to avoid rough handling, which might tend to loosen the steel balls.

D. B.

SAVING TIME ON DETAIL DRAWINGS

Another method of saving time on detail drawings which might be added to those mentioned on page 884 of July MACHINERY is the use of standard sheets, suitably numbered, containing typical details. Duplicates are furnished to each draftsman, who, when adapting the parts shown on these sheets, incorporates them in the regular drawing by making a simple reference note including the sheet number. Similarly, a sheet containing a list of conventional symbols for pipe fittings, electrical instruments, etc., also provides a means of reducing the time consumed in making detail drawings.

Brooklawn, N. J. JOHN W. GARDINER

COMBINATION FULCRUM AND INDICATOR FOR STRAIGHTENING SHAFTS

Straightening shafts in an engine lathe between centers is usually considered an awkward job, as each time the shaft has been sprung by means of a bar and fulcrum, an indicator gage must be clamped in position. The writer has devised a simple tool which makes it unnecessary to set the gage more than once. This tool, which is shown in Fig. 1, consists chiefly of a round fulcrum 2 1/4 inches in diameter and 4 inches long.

A hole is drilled through one end to receive the stem of an indicator gage, which is fastened in position by means of a screw. In Fig. 2, the fulcrum is shown in use. It is placed in a V-block about the same length as the fulcrum, the block resting on the bottom of the toolpost T-slot. In straightening the shaft, the fulcrum is rotated until the indicator is away from the shaft.

One end of the straightening bar is then placed under the shaft and on the fulcrum; after spring-

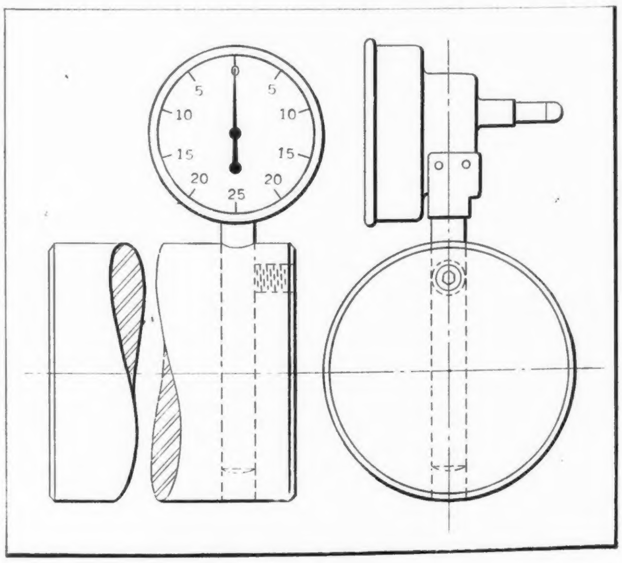


Fig. 1. Fulcrum with Indicator Attached for Straightening Shafts between Lathe Centers

ing the shaft, the bar is removed and the fulcrum is rotated until the indicator point touches the shaft. Now when the shaft is rotated on the centers, if there is any eccentricity, it will be indicated by the gage.

Because of the weight of the fulcrum and the manner in which it is supported on the V-block, the indicator body will not move while it is being used.

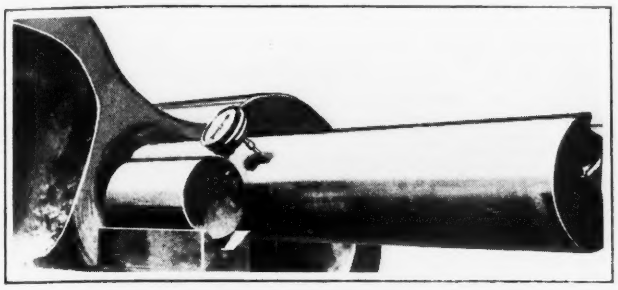


Fig. 2. Fulcrum Shown in Fig. 1 being Used for Straightening Pump Shaft

In case it is desired to straighten a shaft from either side of a large shoulder or collar, the fulcrum can be reversed and the indicator rotated 180 degrees.

New Brunswick, N. J. CHARLES C. TOMNEY

DETECTING CRACKS IN METAL SURFACES

Machined metal parts often have minute cracks in them which cannot be seen by the naked eye, but which are large enough to cause trouble. The best way to detect such cracks is to clean the surfaces and then apply a thin mixture of red lead and gasoline. This mixture should be applied with a brush. In a short time, the gasoline will evaporate, leaving the red lead on the metal. The red lead thus deposited should be wiped off with a clean cloth. If there is a crack in the surface so treated, it can be detected by a careful examination with a magnifying glass, as some of the red lead penetrates the crack and shows up as a thin red streak.

Billericay, England W. E. WARNER

STAMPING DATE OF ISSUE ON BLUEPRINTS

When blueprints are furnished to another manufacturer, it is a good plan to date each print on the white side at the time it is made. Most offices make it a practice to date all blueprints on the blue side with a rubber stamp and blue ink. The date is often blurred, so that it is almost impossible to determine the date of issue. Moreover, a file clerk, receiving revised drawings stamped in this manner, sometimes finds it necessary to refer to the last change on a drawing in order to be sure that he has the latest issue. This, of course, consumes a great deal of time; but by stamping the date of issue, along with the company's name, on the back of the print, it is much easier for anyone to obtain the necessary information at a glance.

Syracuse, N. Y. O. W. JOHNSON

HOLDER FOR GRINDING SQUARE PUNCHES

Grinding square punches so that the sides will be absolutely square with each other is considered by most toolmakers to be a rather difficult job, and many methods are in use for doing this work. A rather simple and economical design of holder for this purpose is shown in the illustration.

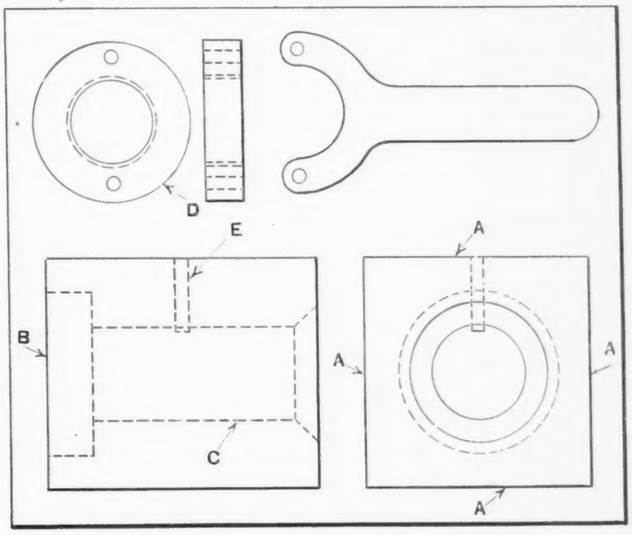
To construct this holder, a block of steel is machined, hardened, and ground on the four sides *A* and on the end *B*. However, before hardening, a hole *C* is bored through the exact center of the block, this hole being a sliding fit for a standard collet such as is used in a bench lathe. One end of the hole is beveled to suit the collet, while the other end is counterbored for the check-nut shown at *D*. In order to prevent rotary movement of the collet, a pin *E* is driven into the block, one end of which engages a slot in the collet.

To use the tool, the shank of the punch is inserted in the collet and the check-nut *D* tightened. The block can then be secured to the grinding machine table so that the four sides of the punch will be ground square and exactly central with the shank. If it is desired to grind the end of the punch square, the block can be set on the end *B* and fastened in this position.

In making the block, it would be well to bore the hole *C* large enough to suit the largest collet available, in order that a wide range of punches may be ground. It is obvious that this type of block can be used for grinding punches with angular as well as square sides by simply constructing it so as to correspond to the angles. Or, in cases where it is desired to offset the punch from the center of its shank, a block may be made which is offset the required amount.

In any case, all the sides, as well as the end of the punch, can be ground without removing it from the block. The nut *D* should be slightly thinner than the depth of the counterbore in the end of the block so that the nut will not protrude.

Scotia, N. Y. SEYMOUR SCHREITER



Inexpensive Holder for Accurately Grinding Punches Square and Central with their Shanks

Questions and Answers

RULES FOR DRAWING SHELLS

A. R. W.—The following rules have been given to the writer as a guide in designing dies for drawing shells. I would like to know if they are in accordance with generally accepted practice.

To find the blank diameter for a shell from the draftsman's drawing, the well-known rule is to multiply the circumference by the height, and after adding the area of the bottom, use a blank equal in area to the total area thus found, allowing additional material for the flange. The amount to be added for the flange depends on the thickness of the stock and should be sufficient to permit the blank-holder to grip the blank firmly against the drawing die during the drawing operation. For stock 1/4 inch in thickness, the allowance should provide a flange not less than 1 inch wide.

To determine the diameter of the shell after the first draw, the following rules are given: For steel, brass, and aluminum, multiply the diameter of the blank by 0.58; for zinc, multiply the diameter of the blank by 0.64.

UNUSUAL CLAIM FOR COMPENSATION FOR INJURY

X. C.—A manufacturing company was engaged in making iron castings, and certain of the molders were entitled to leave for the day when they had finished pouring metal into the molds. There was a limited number of ladles, and this caused some rivalry among the workmen for their possession, in order that each might pour his molds and get away. An argument occurred between two workmen as to who was entitled to a certain ladle, which culminated in a fight and the serious injury of one of the men. The injured workman seeks compensation from the manufacturing company, as employer, under a workman's compensation statute, on the ground that the injury arose in the course of and originated in the employment. Is this workman entitled to recover?

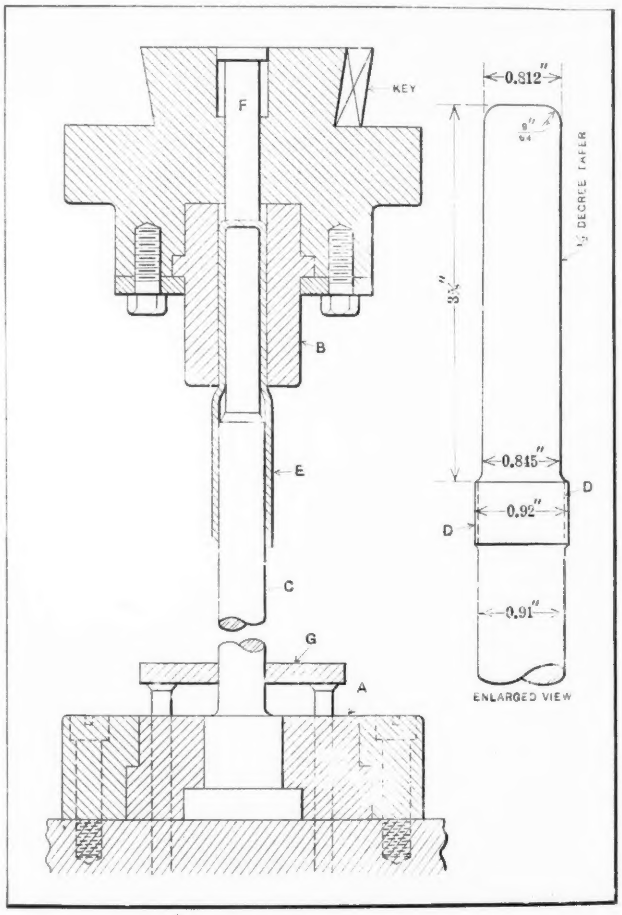
Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

It seems clear that the fight occurred in the course of the employment, but did it also arise out of the employment? The employer required nothing of the men that would cause a controversy, and the men turned from their work to engage in a quarrel of their own making. The general rule is that there must be a reasonable connection between an injury suffered and the employment or circumstances under which it is conducted to entitle an injured workman to compensation. This element seems entirely absent in the question stated, and it is probable that the injured workman will be denied a recovery against his employer. (92 Conn. 382)

DIE FOR DEEP DRAWING

L. M. S.—I have been told that a reducing press having a stroke of 15 inches can be used for drawing shells approximately 15 inches long by 1 inch in diameter. Will some reader please show the design of a drawing die that has been used successfully for work of this kind?

A.—In the accompanying illustration is shown a type of die used in drawing shells 15 or more inches in length. A series of dies of the same general design, but having punches and die members of different sizes to give the proper reduction in diameter at each operation, is required for this class of work. The length of the stroke of the press ram does not need to be increased in proportion to the length of the work being drawn, since the punch is carried on a sliding holder *A* which permits the shell to be placed on the punch without interfering with the die secured to the ram.



Die for Deep Drawing Operations

The upper member *B* is made of tool steel and is secured to the cast-iron holder by means of a collar and machine screws. The lower punch member *C*, which is shown in detail in the enlarged view at the right, is made of tool steel, and is provided with

grooves at *D* which permit the escape of air. The punch is also made with a slight taper to facilitate the stripping or removal of the shell.

The stripper *G* is made of machine steel and is depressed when the shoulder on the punch is reached by the upper die member *B*. The die is also provided with a knock-out *F* in the upper member. This particular die is used on a reducing press having a stroke of 15 inches. Although not shown in the illustration, the edge of the drawing die *B* is rounded in the usual way.

HEAT-TREATMENT OF LEAF SPRINGS

L. R. S.—What is the correct procedure in hardening and tempering leaf springs such as are used on automobiles? The method must not require expensive equipment.

A.—The steels of which automobile springs are made, namely, high carbon and high alloy steels, are very sensitive to heat-treatment and must not be over- or under-heated. They must be heated uniformly; otherwise, brittleness, soft spots, or lack of "life" will result. It is possible to construct, at low cost, a reasonably efficient furnace for heating the springs.

Although by no means ideal, a coal or coke furnace can be used in which the fuel is burned at one side and the flame allowed to pass over the top of the work, which is placed on the floor of the furnace. Such a furnace will be satisfactory if a sufficiently high bridge is incorporated in the design to prevent the flame from actually impinging on the work, and a damper is provided by means of which the temperature can be accurately controlled. The ideal furnace, however, is probably the gas-fired type, which can be so regulated that its temperature will vary but a few degrees.

Briefly, the heat-treatment of leaf springs consists of heating to the correct hardening temperature; quenching in oil or water; reheating to a lower temperature; and either requenching or cooling in air.

The correct quenching temperature for any spring steel is determined by its composition. Many laminated automobile springs are made of plain carbon steel containing between 0.50 and 1.0 per cent carbon. The correct hardening temperature for this material is between 1436 and 1472 degrees F. Some alloy steels, particularly chrome-vanadium steels, are also employed. For the latter, a temperature of between 68 and 140 degrees F. in excess of that used for the plain carbon steel is generally required.

The springs must be slowly and uniformly heated. When a piece of cold spring steel is placed directly in a red-hot furnace, it is likely to become cracked. Preheating in a low-temperature furnace is therefore necessary. In the case of leaf springs, each leaf must be treated separately, for if the spring is hardened as a complete unit, the leaves near the center will not have nearly the same degree of hardness as the outer leaves.

It is only necessary to heat a spring at the hardening temperature for a sufficient time to insure full penetration of the heat to the core of the material. When this is achieved, the spring must be quickly quenched in oil or water. Generally speaking, oil is preferable to water as a quenching medium. This is especially true if the manganese content of the material is high, as water quenching may lead to cracking.

Water quenching, however, may be employed to advantage for springs of large section made of low manganese steel. If oil quenching is employed, the oil must be of a fairly thin consistency, because thick oil will not give the necessary hardness and is likely to result in soft spots in the springs. It is essential that all temperatures for hardening and tempering be regulated by means of pyrometers, as it is only in this way that uniform results can be obtained.

As springs of different cross-section will vary in hardness after quenching—the smaller the section the greater the hardness—the tempering temperature should be varied accordingly. Usually, a temperature of 622 to 932 degrees F. is satisfactory. It is better to heat the springs to a slightly higher temperature than that which is known to give the best results than to under-heat the part, because the worst result from overheating will be a permanent set, which is preferable to a fracture. A constant temperature for tempering is insured by employing a lead bath. If the springs are coated with a little powdered graphite, the lead will not adhere to them. It will be found that the shape and general dimensions of a spring are changed slightly as a result of heat-treatment, and allowance must be made for such changes.

MEANING OF THE TERM "PICK-OFF GEARS"

B. B.—What is the meaning of the term "pick-off gears?" This expression is sometimes used in connection with machine tools. Are such gears the same as change-gears?

A.—The use of the term "pick-off gears" has not been standardized, but this term is generally applied to changeable gears that may be replaced by others to secure a different ratio. The term "pick-off gears" has been used to avoid confusion with the term "change-gears," which is applied more especially to those combinations of gearing intended for frequent changing and which, on many modern machine tools, are permanently grouped together and so arranged that the changes are obtained merely by shifting certain controlling levers. The expression "pick-off gears" has been applied more especially to gears on single-purpose or manufacturing types of machine tools. These so-called "pick-off gears," in some cases, are seldom or never changed, because the machine is used on one class of work, but the name given them indicates that they can be changed if necessary. As to the purpose of these gears, it is evident that they are equivalent to change-gears.

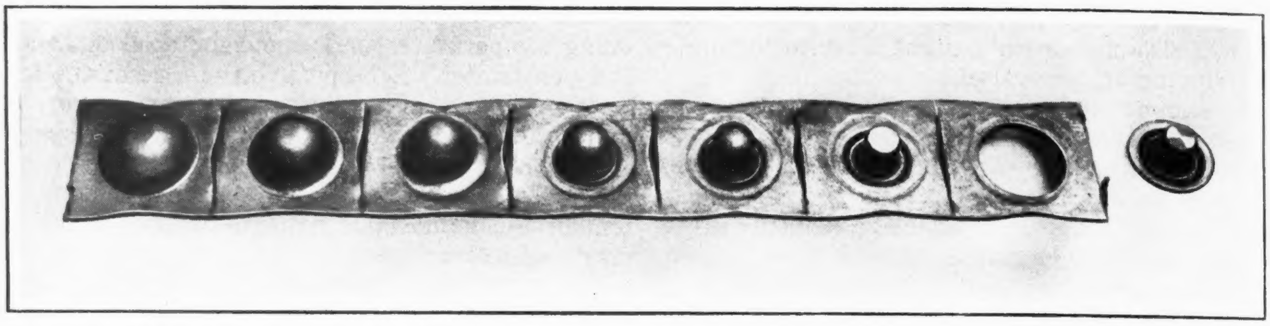


Fig. 1. Development of the Part Shown at the Extreme Right from Flat Stock in a Seven-step Progressive Die

Producing a Seven-step Stamping Every Second

Small stampings of the type shown at the extreme right in Fig. 1 are produced from strip stock at the rate of one per second, or sixty per minute, by the use of the seven-step progressive die illustrated in Fig. 2. This operation is performed in the plant of the Alemite Corporation, Chicago, Ill. Dead soft steel, 0.062 inch thick, is used for the stock. The finished part has an over-all diameter of 15/16 inch and a depth of 7/16 inch.

As will be apparent from Fig. 1, six of the steps consist of drawing and forming the piece from the strip, while at the seventh step the finished piece is blanked out. Obviously, the stock is fed through the die set from left to right as viewed in this illustration.

The unit at the left in Fig. 2 holds seven dies and is attached to the upper reciprocating head of the machine, while the unit at the right contains the punches and is mounted on the bolster plate. With this arrangement, the protuberances formed in the stock point upward and do not interfere with feeding the stock through the die set.

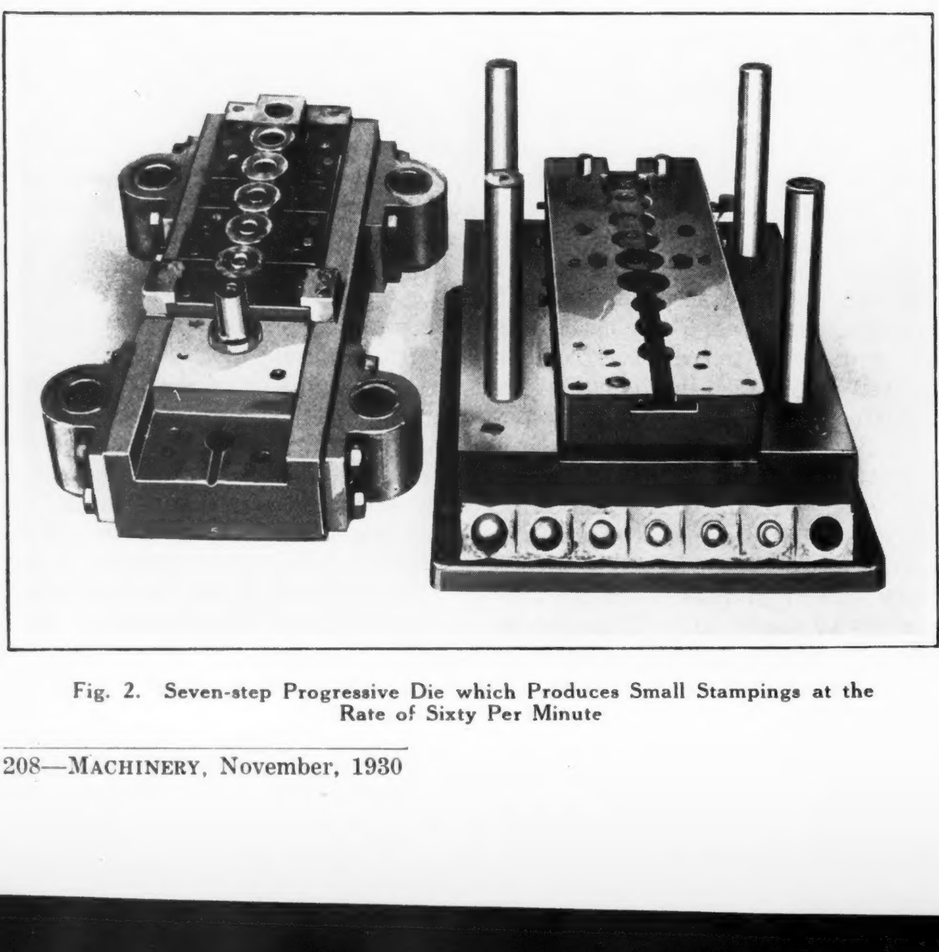


Fig. 2. Seven-step Progressive Die which Produces Small Stampings at the Rate of Sixty Per Minute

Stripper plates fastened to the lower unit, as shown, prevent the stock from sticking to the top unit. At each downward movement of the reciprocating head, these stripper plates are pressed firmly down on the stock. Four guide posts on the lower unit enter bushings in the upper unit to insure accurate alignment of the two parts.

The regular feed-rolls of the machine move the stock forward the required amount between each reciprocation of the upper head, and the punches automatically take care of any slight discrepancies that may occur in the feed. A cutter at the left-hand side of the machine severs the scrap into short pieces. This machine is mounted on I-beams embedded in two feet of concrete.

* * *

WHY MACHINE MANUFACTURERS HAVE SERVICE DEPARTMENTS

Years ago manufacturers of machine tools found it sufficient merely to build a machine, sell it to the customer, and deliver it to his shop. After that, the seller did not need to worry about the matter further. Today, successful manufacturers do not consider the transaction closed until the machine produces all that it is capable of doing under the best conditions of tooling and operation. Thus have grown into being the extensive service departments now maintained by leading machine tool builders. These service departments see to it that the machines sold are equipped with properly designed and made tools, suited to the work to be performed. In addition, demonstrators frequently train the operators that are to handle the machines in order to make sure that the best results will be obtained.

Some Characteristics of Stainless Steel

The Difference in Forging Pressures Required for Stainless and Ordinary Steels was One of the Important Points Brought out in a Paper Read before the American Drop Forging Institute

ONE of the papers that attracted a great deal of interest at the fall meeting of the American Drop Forging Institute held at Briarcliff Manor, N. Y., October 9 to 11, was that read by Earl Smith of the Republic Steel Corporation on the subject of stainless steel. Mr. Smith pointed out some of the differences between this class of steel and those ordinarily handled in drop-forging shops.

Stainless steel contains chromium as its most important alloying element. It was pointed out that chromium alloys are easily coarsened by heat. They are also brittle when cold, unless properly heat-treated. While these properties may be objectionable under certain circumstances, they are the basis of many useful applications. The fact that chromium alloy steels are coarse-grained and stiff while hot permits them to carry loads at high temperatures. The fact that they are brittle when cold permits them to be machined in some cases when this would otherwise be impossible.

Stainless Steels Require Greater Forging Pressures than Ordinary Steels

To the steel mill and forging man, the strength at high temperatures becomes an important point. In hot-rolling, approximately twice the power is required that would be necessary for ordinary steel. A mill that will produce a strip 10 inches wide and 0.060 inch thick from ordinary steel will require the application of the most careful workmanship to produce a chrome-nickel stainless strip 0.110 inch thick. A piercing mill with an 800-horsepower motor capable of an overload of 1200 horsepower for short periods pierced common steel with no effort. A billet of the same size of low-carbon material, containing high percentages of chromium and nickel, stalled the mill. This indicates the difference in working stainless steel and ordinary grades of steel.

Ordinary steels become soft when heated to above 1000 degrees F., and flow readily under a pressure of 4000 pounds per square inch or more. High-chromium steels require 7000 pounds per square inch, and if the chromium is supplemented by nickel, a still higher pressure is needed. For example, a steel with 20 per cent chromium and 20 per cent nickel, with 0.25 per cent carbon, will require 10,000 pounds per square inch and sometimes upward of 20,000 pounds to make it flow, at a temperature of 1100 degrees F. or higher.

At forging temperatures, the ultimate strength of ordinary steel is below 4000 pounds per square inch. A 15 per cent chromium steel has a strength of over 10,000 pounds per square inch, and a nickel-chromium-tungsten steel, over 12,000 pounds.

Steels that are produced specifically for corrosion resistance, rather than for resisting high temperatures, divide themselves into two groups — those containing less than 0.07 per cent carbon and those containing more than this amount. The ordinary corrosion-resisting chrome-nickel steels contain 0.10 per cent carbon, 18 per cent chromium, and 8 per cent nickel. To obtain a corrosion-resisting product, the material must be heated rapidly to 2100 degrees F. and suddenly cooled. Only thin sheets 1/16 inch thick or less can be air-cooled safely. Bar sections, forgings, and similar parts must be quenched in water. When the material is welded, the corrosion-resisting properties are greatly increased if the welded parts can be reheated to 2200 degrees F. and water-quenched.

Preparing Stainless Steel for Polishing

When stainless steel is to be polished, the treatment preparatory to polishing is of the greatest importance. The material must be scrupulously freed from scale, either by pickling or grinding—preferably the latter. No polishing operation should be undertaken until all scale is thoroughly removed. All polishing compounds must be free from iron-bearing materials.

To produce the maximum degree of corrosion resistance, the polished part should be subjected to the following treatment: All grease is removed by washing with kerosene and wiping with whiting. This is followed by a hot-water wash. The part is then immersed in a bath containing 30 per cent of nitric acid, by volume. The part should remain in this bath for at least twenty minutes, the temperature of the bath being 140 degrees F. This immersion is followed by washing in water. In the case of highly polished materials, the last polishing operation is then repeated.

An instructive paper entitled "Fuel Oil and Furnaces" was read by R. C. Hopkins of the Volcanic Specialties Co. In this paper, directions were given for obtaining the greatest possible economy in the use of fuel oil and furnaces. Another paper, which brought out new ideas of great importance in the drop-forging field, was presented by H. W. McQuaid of the Timken Steel & Tube Co.; this paper was entitled "Grain Size and its Relation to Forgings." The author pointed out that in steels of identical composition, the grain size changes the forging and machining characteristics of the steel to a great extent, and a study of the grain size in steels intended for gears and similar parts is as important as a study of the chemical composition. A. R. Peirce of the National Metal Trades Association spoke on "Experiences with Foremanship Training in the Metal Trades Industry."

Machine Tool Builders Discuss Marketing

The Need for Adequate Market Surveys was the Keynote of the Annual Convention of the National Machine Tool Builders' Association

THE twenty-ninth annual convention of the National Machine Tool Builders' Association was held at the Aspinwall Hotel, Lenox, Mass., October 13 to 15. The meeting was unusually well attended, being one of the largest ever held by the Association. In his opening address, the president, Carl A. Johnson, president of the Gisholt Machine Co., Madison, Wis., reviewed briefly the present state of business in the industry, calling attention to the upward trend that has been in evidence during the past month. The indications are that the depression reached its low level in July and that we are now definitely on the upward grade, although the improvement that has been recorded so far in industry has been comparatively slight.

Carl A. Johnson, Re-elected President of the National Machine Tool Builders' Association

Marketing is Now the Most Important Problem of the Machine Tool Industry

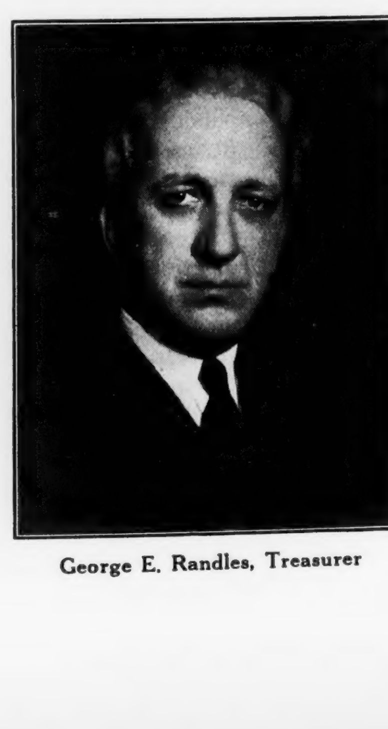
Recognizing the fact that market research and market analysis are among the most pressing problems not only of the machine tool industry, but of the industries of the United States in general, one entire session of the meeting was devoted to the subject of marketing. Frederick V. Geier, vice-president of the Cincinnati Milling Machine Co., Cincinnati, Ohio, made a most effective presentation of the subject "The Next Forward Step—Marketing." As a result of this address, the Association made a substantial appropriation for carrying on market research in the shop equipment field.

A carefully prepared survey of machine tool equipment, illustrated by charts, was presented by K. H. Condit, editor of the *American Machinist.* This paper pointed out that more than 50 per cent of the machine tool equipment in use in American machine shops is over ten years old, and that much of the equipment is so old as to require immediate replacement in order to conduct manufacturing on an efficient basis.

In an address by W. L. Churchill, industrial economist of White Plains, N. Y., on the subject of price and its relation to manufacturing and selling cost, the results of careful marketing methods were again emphasized. It was pointed out that, in general, greater attention must be given to marketing problems and that the saving in marketing expense often results in reduced returns on the capital invested in the enterprise. The speaker said that machinery manufacturers could profitably spend more than they do on marketing research.

Robert M. Gaylord, First Vice-president

C. R. Burt, Second Vice-president



George E. Randles, Treasurer

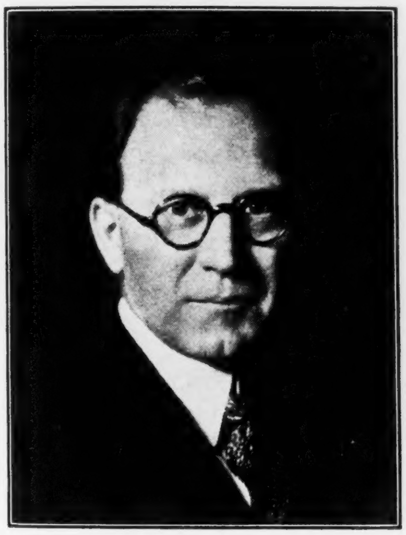
A Review of Business Conditions

In a report presented by Ernest F. DuBrul, general manager of the Association, a brief review of business conditions was given. Judging from the experience of the industry in 1921, 1924, and 1927, the demand for machine tools should show an upward trend from now on. The depression this year was more serious than in 1927, but was not so serious as in 1924. It has again been shown that the higher the boom preceding a depression, the more serious the depression. Because of the extent of the boom in 1929, the country is really fortunate in not having suffered a more severe depression than it has. The recovery may be somewhat slow, but it is quite certain that conditions have begun to improve definitely.

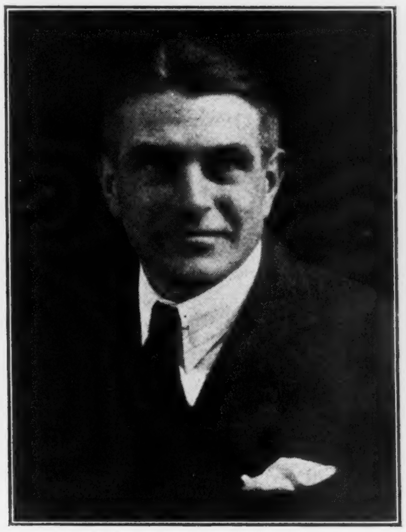
Mr. DuBrul also briefly reviewed the fundamental factors that make for success in any industrial machinery business. These factors he enumerated as design, selling efficiency, service, good will, and price. The first four of these factors are elements of slow growth, developed only through painstaking and careful effort. The fifth element, price, is the only one that can be changed easily at will. It is one of the great drawbacks of industrial management that so many manufacturers do not realize that price is the least important of the five elements making for industrial success. Price reductions frequently result merely in a reduction in the profits of business, without any actual increase in sales.

Election of Officers

At the meeting, the president of the Association, Carl A. Johnson, was re-elected to serve during the coming year; Robert M. Gaylord, president of the Ingersoll Milling Machine Co., Rockford, Ill., was elected first vice-president; C. R. Burt, president of the Pratt & Whitney Co., Hartford, Conn., was elected second vice-president; George E. Randles, president of the Foote-Burt Co., Cleveland, Ohio, was elected treasurer. Three new directors were elected to serve for three years, as follows: F. H. Chapin, president, National Acme Co., Cleveland, Ohio; Henry S. Beal, assistant general manager, Jones & Lamson Machine Co., Springfield, Vt.; and Richard A. Heald, treasurer of the Heald Machine Co., Worcester, Mass.



F. H. Chapin, Newly Elected Director



Henry S. Beal, Newly Elected Director

R. A. Heald, Newly Elected Director

* * *

CONVENTION OF ASSOCIATED MACHINE TOOL DEALERS

The annual meeting of the Associated Machine Tool Dealers was held at the Hotel Aspinwall, Lenox, Mass., October 6 and 7. Kenneth H. Condit, editor of the *American Machinist*, addressed the session on the subject of Machine Tool Obsolescence. Mr. Condit's address was illustrated by charts showing percentage figures by industries. A discussion of the proposed standard sale proposal form was led by J. R. Porter. The chairman led a discussion on the possible development of a uniform plan for handling time sales. The following officers were re-elected for the coming year: President, E. P. Essley, secretary of the E. L. Essley Machinery Co., Chicago, Ill.; vice-president, J. W. Wright, president of the Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; secretary and treasurer, A. G. Bryant, general manager of the machinery division of Joseph T. Ryerson & Son, Inc., Chicago, Ill.

* * *

The Steel Founders' Society of America, Inc., representing the steel casting plants of the country, has provided for the arbitration of disputes arising in the industry by including in its Standard Trades Customs the arbitration clause of the American Arbitration Association whose headquarters are at 521 Fifth Ave., New York City. A constantly increasing number of industrial groups are availing themselves of the arbitration method of settling disputes, having found that our legal machinery is too slow and out of date to meet the needs of modern business.

How to Obtain the Best Results from Gages*

Care and Maintenance of Working and Inspection Gages that will Insure Accuracy in the Product, Minimize Rejections and Secure Long Gage Life

WEAR tolerances should be established for all gages used in a factory, including master gages, inspection gages, and production gages. A definite time should be set for the inspection of each gage, and the condition of the gage should be recorded at each inspection. In some cases, it has been found necessary to inspect gages every hour, and in other cases every few hours. In other instances, inspection once a day or once a week is sufficient to prevent the use of gages that have been worn below the established limits.

In some factories, each gage is numbered and on a card bearing this number is kept a complete record of the gaging sizes. With such an inspection and record system, it is practicable to have the inspection department exchange gages with the production department when the gages in the latter department have become worn to a smaller size than those of the inspection department, but are still above the basic size. This practice serves to eliminate disputes regarding the sizes of work, which frequently occur because the worn gages in the production department are smaller than those in the inspection department. This is particularly applicable to thread gages.

Plug gages wear faster on the front end, so that an allowance must be made in setting up the wear limits at which gages must be replaced, to take care of this factor. Gages of ordinary size should be rejected when they become worn 0.0002 inch under size 1/4 inch back from the front end, and 0.0001 inch under size at the back end. The general average, under ordinary conditions, is 1000 gagings per 0.0001 inch wear on new lapped gages.

Uniform Hardness of Gages is of Great Importance

Soft spots in gage surfaces are a source of uneven and consequently excessive wear. It requires special steels to consistently obtain surfaces that are 100 per cent hard. It seems to be more important that the gages be uniformly hard than that they be excessively hard. In fact, some tests have shown that comparatively soft but uniform gages have worn longer than extremely hard gages. In one case, it was found that a hard gage would only stand up for from twenty-five to fifty gagings of an extremely hard piece of work, whereas a file-soft gage, carefully used, would gage several hundred pieces before appreciable wear developed.

It is usually necessary, however, to have a reasonably hard gage to prevent accidental bruising or scoring of the surface. Soft steel and thinly casehardened gages are likely to become bruised, upsetting the metal and consequently changing the gaging size. Gages that have met with accidents of this nature are difficult to repair in a satisfactory manner.

The metal being gaged has an important bearing on the life of the gage. Aluminum, brass, and cast iron are all much harder on gages than soft steel. Some grades of aluminum cause excessive wear, particularly if there is any tendency to force the gage. Brass parts, especially those with a high percentage of copper, can be gaged with less wear if a small amount of light lubricant is used on the gage.

It is important that the material from which gages are made be kept free from soft spots. General practice indicates that crucible alloy steel with a high carbon content at the gaging surface makes the most economical and satisfactory gage.

Tungsten-carbide gages, although very high in first cost, can be used with economy where there is high production and excessive wear of the gages, and particularly where close tolerances must be maintained. The wear on "Not Go" gages is considerably less than on "Go" gages. Generally, three "Go" gages will be used up to one "Not Go" gage.

Precautions in Measuring Gages

The method employed in measuring is an important factor in checking gages for wear. In general, soft gages do not permit of accurate measurements, first because it is difficult to obtain a flat, smooth finish; and second, because the soft nature of the material permits the measuring surfaces to sink in to a certain extent. This is especially true in measuring soft threads with wires. Errors in reading micrometers and measuring machines are usually less than the errors in the instruments themselves; that is, it may be possible to split 0.0001 inch in reading a micrometer scale, but the inaccuracies in the micrometer screw or the anvil surface, resulting from wear, may be 0.0001 or 0.0002 inch.

The contact pressure in making measurements is an important factor, particularly when using balls, rolls, or wires. When using wires in measuring threads, the practice approved by the Bureau of Standards is that threads finer than 20 per inch are checked with a measuring pressure of 8 ounces, and threads 20 per inch and coarser are checked with 3 pounds pressure. It is recommended that the wires be calibrated when crossed over a roll 0.750 inch in diameter. Pressure is also an important factor in checking taper ring-gages. They should be thoroughly cleaned and the test plug inserted until it seats, no pressure being applied. The taper plugs are usually checked by the use of wires or rolls.

*Abstract of a paper presented by E. J. Bryant of the Greenfield Tap & Die Corporation at the Production Meeting of the Society of Automotive Engineers in Detroit, Mich., October 7-8.

Effect of Change in Temperature on Gages

On large work, temperature is a factor to be considered in checking. By bearing in mind the fact that the change due to temperature is approximately 0.0001 inch in a length of 16 inches for each degree F., it can readily be determined how important the temperature factor is for a particular job. With a gage 32 inches long, having a tolerance of 0.0002 inch, one degree difference in temperature would take up the full tolerance.

Testing Gages for Wear

In measuring a gage to determine the amount of wear that has taken place, it is important that the checking tools make contact at the point on the gage where the wear occurs. For instance, a snap gage with flat anvils on one side and round anvils on the opposite side, such as is used in gaging round shafts, will have a tendency to wear a groove through the flat anvil. These gages cannot be reset accurately with plugs unless the groove has been removed by lapping to obtain a new flat surface. Thread gages wear more rapidly on the crest of the threads. Ring thread gages show practically no wear when checking with a setting plug of the basic outside diameter, but will frequently show considerable wear when tested with a checking gage that is truncated to 60 per cent of the full depth. These inequalities of wear on the gaging surface cause most of the disputes between the production and inspection departments. Two gages may appear to be of the same size according to the check plug, but due to inequalities of wear on the gaging surface, they will pass work in which there is considerable variation in size.

The wear of plungers on indicating gages, which gives them a slight side movement, is also a frequent cause of error. Worn gages should be rejected when they have reached an established limit of wear. In the case of "Go" gages this limit should be the basic size, although in some instances it is permissible for the sake of economy to establish the wear limit at a point under the basic size.

Progress in Gear Manufacturing Standards

The meeting of the American Gear Manufacturers' Association, in progress at Niagara Falls, Canada, when the last number of MACHINERY went to press, as mentioned on page 135 of October MACHINERY, was one of unusual interest to those attending the meeting. As is customary at the meetings of this Association, the work of the Standardization Committees held the center of the stage. A number of committee reports were considered, among which was a thorough and carefully prepared progress report on "Gearing Nomenclature," submitted by the Nomenclature Committee, of which Douglas T. Hamilton, of the Fellows Gear Shaper Co., Springfield, Vt., is chairman. A revision of the recommended practice for computing the horsepower of non-metallic spur gears composed of laminated phenolic materials or rawhide was adopted by the Association.

In his remarks at the opening of the meeting, B. F. Waterman of the Brown & Sharpe Mfg. Co., Providence, R. I., president of the Association, made a plea for further efforts along the lines of active standardization work. A. A. Ross of the General Electric Co., Lynn, Mass., chairman of the General Standardization Committee, reviewed the standardization work of the Association from its beginning thirteen years ago, and C. B. LePage, assistant secretary of the American Society of Mechanical Engineers, in his address on gear standardization and research, reviewed similarly the joint activities of the Association with other technical societies.

A number of papers, mentioned in October MACHINERY, were read. In addition, Ansel R. Peirce, director of the department of industrial education of the National Metal Trades Association, outlined the purposes of foremanship training. He gave the following objectives as the most important in training of this kind: To improve cooperation in the plant between the foreman and the workman, other foremen, and the management; to give the foreman a broader view of his responsibilities; to stimulate in him a desire to study modern methods and policies in handling employes, materials, and machinery; to assist him in developing dormant leadership qualities; to aid him in making a comprehensive analysis of his job; to better equip him to train new employes; to give him a better understanding of the plans, policies, and ideals of the management, so he can, in turn, pass them on to the workmen; to bring out clearly the importance of being straightforward and impartial in dispensing justice; to enable the foreman to see the balanced teamwork of the whole plant, and his place on the team; to stimulate job pride; to encourage an early appraisal, appreciation, and solution of the problems and difficulties confronting a new employe; to better acquaint the foreman with the factors entering into job organization; to promote better human relations; and to improve the foreman's knowledge of industrial economics and prepare him to impart his knowledge to the workmen in a way they can understand.

In his address, Mr. Peirce also briefly outlined the methods that have been found most successful in conducting foremen's conferences. He emphasized especially the importance of removing the formal atmosphere from these gatherings, so that the men taking part in them will feel free and easy and will express their opinions without reservation. The leader should avoid giving the conference the atmosphere of class-room instruction.

New Developments in Machining Aluminum*

Methods Recommended for Machining Aluminum and Aluminum Alloys, Based both on Laboratory Experiments and on Everyday Shop Practice

IMPROVEMENTS are constantly being made both in machine tools and in aluminum alloys that cause changes to be made in the methods of machining aluminum. The introduction of tungsten carbide for cutting tools has also greatly modified the practice in machining aluminum. Considerable experimental work, substantiated by data from the production field, makes it appear that a tool shaped essentially as shown in Fig. 1 is best suited for machining aluminum and its alloys. Such a tool should have a top rake of about 45 degrees, a side rake of about 15 degrees, and a front or back clearance of about 7 degrees, making the total included angle of the cutting edge approximately 38 degrees. The edges of this tool must be keen, that is, they must be smooth and free from wire-edges or burrs.

When used under proper conditions, a tool meeting the requirements described will produce a clean-cut smooth surface on the work; generate a minimum amount of frictional heat; and cause little, if any, deposition of metal on the top of the cutting edge of the tool. Although such a tool may be considered best suited for cutting aluminum and its alloys, it may not always produce the greatest amount of finished work with the least attention or within the shortest time at the lowest cost—that is, it may not be the most efficient tool to use under every operating condition.

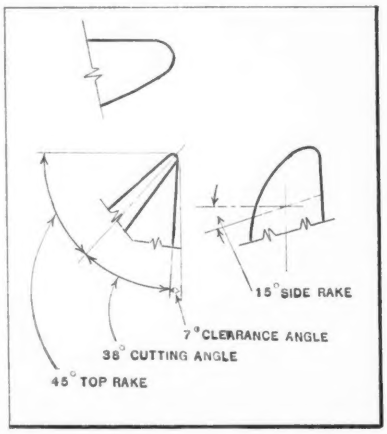


Fig. 1. Tool Form for Machining Aluminum

Limitations Imposed by Type of Tool

The type of tool frequently imposes limitations that materially decrease the production rate, because the desired shape requirements cannot be met. This is sometimes the case with circular forming tools having a considerable difference between the largest and the smallest diameters. In such cases, it may be quite impracticable to use the desired cutting edge angles. Again, the cutting edges of the tool may be of the required shape, but the design is unsatisfactory because ample provision has not been made for taking care of the continuous and but slightly curled chips that are characteristic of many aluminum alloys. Such difficulties are sometimes encountered in the use of automatic die-heads.

The material from which the tool is made affects not only the life of the tool but also its cutting rate. The choice of the tool material, whether high-carbon or high-speed steel, or tungsten carbide, will be governed to some extent by the type of tool, the machine in which the work is to be done, and the character of the work. High-carbon steel tools ground to the thin cutting edges necessary for machining aluminum soon fail because of brittleness. High-speed steel tools give much better results, except when they are used for machining aluminum alloys containing appreciable amounts of silicon. The high-silicon alloys, however, can be readily machined on a production basis with tungsten-carbide tools. Tools that exhibit the greatest amount of toughness seem to give the best results in machining aluminum, and other things being equal, these should be selected.

The rate of cutting is a function of speed, feed, and depth of cut. These factors may all be, and usually are, closely related not only to each other but also to any or all of the other factors under consideration. If, for example, the tool is of the required shape, very high speeds can frequently be used in machining aluminum. It may be, however, that the comparatively thin cutting edges of the tools will necessitate using rather fine feeds with a moderate depth of cut, or moderate feeds with a small depth of cut.

When the type of tool is such that cutting edges of the desired shape cannot be used, that is, when the maximum top rake cannot be employed, there may be a marked curling of the chips with an accompanying increase in frictional heat. Under such conditions, a lower cutting speed, a smaller feed, a smaller depth of cut, or more coolant must be used.

If the dimensional tolerances are close, an appreciable rise in temperature must be prevented. This is usually accomplished by resorting to lower speeds or less feed than would otherwise be used.

Best Coolants for Machining Aluminum

Experience indicates that a mixture of lard oil and coal oil, or kerosene, usually of equal parts, generally gives satisfactory results when used as a coolant. The proportions indicated can often be varied to advantage, depending on the character of the work. For heavy cuts, more lard oil is used, and for light cuts at high speed, more kerosene may be used. Satisfactory results are also frequently obtained with solutions of soluble oil and water.

*Abstract of a paper presented by R. L. Templin of the Aluminum Co. of America at the Production Meeting of the Society of Automotive Engineers in Detroit, Mich., October 7-8.

The Results Obtained Depend Largely on the Condition of the Machine Tool Used

The machine tools used in machining aluminum are sometimes of such design or are in such mechanical condition that satisfactory results cannot be obtained. Worn spindle bearings, lost motion in lead-screws or in feed mechanism, and too much spring in toolposts, arbors, or holders, permitting "chatter" or "hogging" of the cutting tools, are all factors that prevent satisfactory results from being obtained.

Until recently, many machine tools, otherwise suitable for machining aluminum, were not designed to provide the high cutting speeds recommended for this material. Most of the standard types of machine tools available were designed primarily for machining brass or steel. The introduction of the tungsten-carbide tools, however, has shown the need for higher cutting speeds. These higher spindle speeds, and other features that go with the increased cutting speeds, are now found in some of the newer machine tools. In general, these features are distinct advantages in machining aluminum.

A machine tool operator who has had considerable experience in machining brass and steel frequently questions the use of tools having the extreme shape recommended for aluminum. Generally, the more extensive his experience with other metals, the greater his reluctance in accepting or trying out new ideas. Frequently difficulties in machining aluminum in a production shop have been traced to this cause. For satisfactory results, it is necessary that the operators understand what the proper tool shapes for machining aluminum are and that they apply them correctly.

Tools Best Suited for Machining Aluminum

Frequently it is possible to provide tools with the proper shape of cutting edge by merely regrinding available tools of standard shape. The helical type of milling cutters and end-mills having considerable top rake on their cutting edges give good results in machining aluminum. This is also the case with spiral fluted taps, but in nearly all such tools the cutting edges could be made thinner to advantage. This usually can be done by grinding the cutting edges with an increased amount of top rake.

The form of tool bit shown in Fig. 2, which is usually made of high-speed steel, can be readily adapted to lathe, shaper, or planer tools, inside boring tools, and even face milling cutters with marked advantage. This form of tool bit is readily made from round stock and is easily resharpened and replaced. Quite a range of settings for different amounts of top and side rake can be obtained by rotation of the bit or bits in the holders.

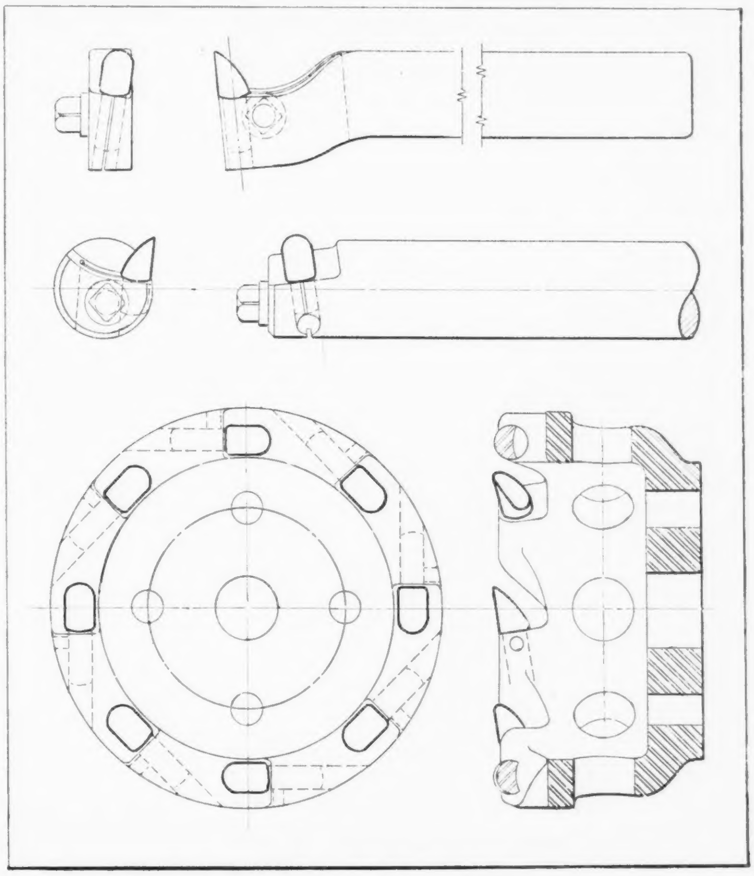


Fig. 2. Tool Bits Made from Round Stock, Ground for Machining Aluminum, as Applied to Tool-holders and Milling Cutters

A face milling cutter with six inserted teeth ground to the required shape for machining aluminum, that is, with a 45-degree top and side rake, has been operated at 350 revolutions per minute, using a feed of 1 1/2 inches per minute when taking a cut 1/8 inch deep and 6 inches wide in cast duralumin, soluble oil and water being used as a coolant. Although quite satisfactory results were obtained with this cutter when used as described, much better results could undoubtedly have been obtained had higher spindle speeds been available and had tungsten-carbide tool bits been employed.

Cutting Aluminum with Circular Saws Having Tungsten-carbide Tips

Recently there have appeared on the market circular saws with cemented-tungsten-carbide tipped teeth. The saws are regularly furnished with various amounts of top rake on the teeth, different tool spacing, and two or three styles of cutting edge and swage. The saws with the tooth shape meeting the requirements indicated previously in this article are recommended by the maker as being suitable for cutting asbestos, composition board, red fiber, cork products, gypsum block, linoleum, ply woods, and composition wall boards. Under proper operating conditions, however, such saws will cut aluminum much better than the customary type of circular saw. The proper operating conditions call

for high speeds up to 12,000 feet per minute or possibly more; comparatively light or positive mechanical feeds; secure clamping of the work; and some suitable coolant, such as soluble oil and water.

Such saws cannot be used successfully in hand or gravity-fed types of sawing machines, or where the work is insecurely clamped in place. Light feeds must be used to relieve the strain on the thin edges of the saw teeth and to produce chips that will free themselves readily from both the saw and the kerf. A positive feed must be used, so that the hook-shaped teeth will not "hog" into the work and thus break off the tips of the teeth. High-speed steel teeth of similar shape and design will give satisfactory results in sawing many of the alloys of aluminum, but the high-silicon alloys require the use of tungsten-carbide teeth for best results.

* * *

LINCOLN WELDING COMPETITION

The Lincoln Electric Co., Cleveland, Ohio, has announced a second arc-welding prize competition in which $17,500 will be awarded in prizes for the forty-one best papers on arc-welded construction submitted in the competition. The Jury of Awards that will judge the papers will be composed of the electrical engineering department of Ohio State University under the chairmanship of Professor Erwin E. Dreese, head of the department, and any other engineers that he may select.

In announcing this competition, which is the second in which the Lincoln Electric Co. has awarded prizes, it is mentioned that the company intends to establish this as a biennial competition. The purpose is to stimulate designers and engineers in every line of industry to consider the application of arc welding to the manufacture of their own products, and to increase their knowledge of the feasibility of such application. The competition is open to anyone throughout the world, except employes of the Lincoln Electric Co. The closing date for the competition will be October 1, 1931. Details covering the rules of the competition may be obtained by communicating with the company.

The forty-one prizes offered to the winners selected by the Jury of Awards include a first prize of $7500, a second prize of $3500, a third prize of $1500, a fourth prize of $750, a fifth prize of $500, a sixth prize of $250, and thirty-five prizes of $100 each. In the previous competition sponsored by the company, the prizes were awarded through the American Society of Mechanical Engineers.

ARC-WELDED PATCHES PROTECT SHELL AGAINST HEAT

In the accompanying illustration is shown a cast-steel shell with patches of alloy steel applied to prevent the surfaces from being burned through by the heat from four oil burners. The cast-steel shell is about 75 inches long, 52 inches wide, 43 inches high, and weighs 5000 pounds. It forms the inner wall of a water-sealed annealing furnace having an outer chamber of firebrick. The heat of the flames in the chamber outside the shell destroyed or burned the metal after a very short time. It was to overcome this trouble that the four alloy steel patches were applied to the areas subjected to excessive heat.

Steel Shell with Arc-welded Patches Applied as Protection Against Flame

The patches shown in the illustration are 24 inches wide by 32 inches long and are about 11/32 inch thick. They are composed of alloy steel containing about 25 per cent nickel and 18 per cent chromium. The work of applying the patches was done by the Mossberg Pressed Steel Corporation, Attleboro, Mass., in the following manner: First, the material in the form of welding rod 5/16 inch in diameter was cut to length and bent to fit close to the surfaces to be covered. These pieces were placed parallel with each other, a space of about 5/16 inch being left between adjacent rods. The patches were then formed by arc-welding these rods in place and filling in the spaces between the rods. Although the shell patched in the manner described has been in use only a short time, it is expected that the patches will lengthen its life to at least three times that of an unpatched shell.

* * *

THE WORLD'S SHIPBUILDING

According to statistics published by Lloyd's Register, there was a decline in the total tonnage under construction on June 30, 1930, of not less than 223,000 tons, compared with three months previously. It is generally conceded that shipbuilding has been somewhat overdone all over the world, and these figures would tend to indicate that this is the case. Of the 311 ships under construction in Great Britain, 177 were steamships, while 125 were oil engine ships, 9 being sailing vessels. For the first time in many years, the United States holds the next place to Great Britain in the construction of sea-going vessels, displacing Germany by a narrow margin; Holland, France, and Russia follow in the order mentioned.

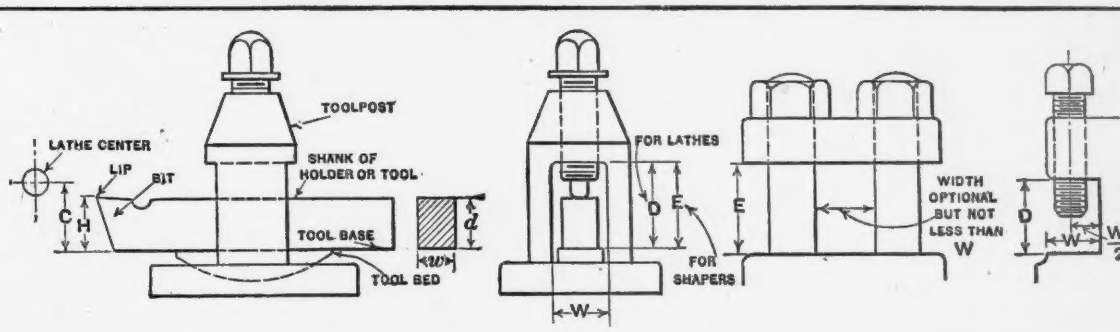
SPEEDS FOR THREADING AND CUTTING-OFF PIPE

Nominal Diameter of Pipe	Outside Diameter of Pipe, Inches	Cutting Speed in Feet per Minute								
		10	15	20	25	30	35	40	45	50
		Revolutions per Minute								
1/8	0.405	95.0	142.0	189.0	236.0	283.0	333.0	378.0	428.0	472.0
1/4	0.540	71.0	106.0	142.0	177.0	212.0	249.0	284.0	320.0	354.0
3/8	0.675	57.0	85.0	113.0	141.0	169.0	200.0	226.0	257.0	282.0
1/2	0.840	46.0	68.0	91.0	113.0	136.0	161.0	182.0	207.0	226.0
3/4	1.050	37.0	54.0	73.0	91.0	109.0	130.0	146.0	167.0	182.0
1	1.315	29.0	43.0	58.0	72.0	87.0	102.0	116.0	131.0	144.0
1 1/4	1.660	23.0	34.0	46.0	57.0	69.0	81.0	92.0	104.0	114.0
1 1/2	1.900	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
2	2.375	16.0	24.0	32.0	40.0	48.0	56.0	64.0	72.0	80.0
2 1/2	2.875	13.0	20.0	26.0	33.0	40.0	46.0	52.0	59.0	66.0
3	3.500	10.9	16.4	21.8	27.3	32.7	38.2	43.6	49.1	54.5
3 1/2	4.000	9.6	14.3	19.1	23.9	28.7	33.6	38.2	43.2	47.8
4	4.500	8.5	12.7	16.9	21.2	25.4	29.8	33.8	38.3	42.4
4 1/2	5.000	7.7	11.5	15.3	19.1	22.9	27.0	30.6	34.7	38.2
5	5.563	6.9	10.3	13.7	17.2	20.6	24.2	27.4	31.1	34.4
6	6.625	5.8	8.6	11.5	14.4	17.3	20.3	23.0	24.1	28.8
7	7.625	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0
8	8.625	4.4	6.6	8.8	11.0	13.3	15.4	17.6	19.8	22.0
9	9.625	3.9	5.9	8.0	10.0	11.9	13.7	16.0	17.6	20.0
10	10.750	3.6	5.3	7.1	8.9	10.6	12.6	14.2	16.2	17.8
11	11.750	3.3	4.9	6.5	8.1	9.7	11.6	13.0	14.9	16.2
12	12.750	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0

MACHINERY'S Data Sheet No. 189, New Series, November, 1930 Contributed by F. A. Firnhaber

STANDARD DIMENSIONS OF TOOL SHANKS AND TOOLPOST OPENINGS

Approved by American Standards Association, April, 1929



Tool Number	Shank Section of Tool or Holder				Opening in Lathe Toolpost				Center Height of Lathe		Height of Tool Lip	Opening in Planer or Shaper Toolpost		
	Nominal Size		Maximum Size		Nominal Size		Minimum Size		Nominal Size	Maximum Size	Minimum Size	Nominal Size		Minimum Size
	d	w	d	w	D	W	D	W	C*	C	H*	E	W†	E
00	3/4	3/8	0.85	0.40	1 3/8	1/2	1.27	0.49	7/8	0.93	0.75	1 1/16	1/2	1.04
0	7/8	7/16	0.99	0.48	1 1/2	9/16	1.48	0.57	1	1.09	0.87	1 1/4	9/16	1.19
1	1	1/2	1.15	0.56	1 3/4	11/16	1.72	0.68	1 3/16	1.26	1.00	1 7/16	11/16	1.38
2	1 1/4	5/8	1.34	0.67	2	13/16	2.00	0.81	1 3/8	1.47	1.25	1 5/8	13/16	1.61
3	1 1/2	3/4	1.56	0.80	2 3/8	1	2.34	0.96	1 9/16	1.72	1.50	1 7/8	1	1.87
4	1 3/4	7/8	1.81	0.95	2 3/4	1 3/16	2.71	1.14	1 13/16	1.99	1.75	2 3/16	1 3/16	2.17
5	2	1	2.11	1.13	3 1/8	1 3/8	3.16	1.35	2 1/8	2.32	2.00	2 9/16	1 3/8	2.53
6	2 1/4	1 1/4	2.43	1.34	3 11/16	1 5/8	3.65	1.61	2 7/16	2.67	2.25	3	1 5/8	2.92
7	2 3/4	1 1/2	2.86	1.60	4 1/4	1 7/8	4.29	1.91	2 7/8	3.15	2.75	3 7/16	1 7/8	3.43
8	3	1 3/4	3.34	1.90	5	2 1/4	5.00	2.27	3 3/8	3.67	3.00	4	2 1/4	4.00
9	3 1/2	2	3.87	2.26	5 3/4	2 3/4	5.80	2.70	3 7/8	4.25	3.50	4 3/4	2 3/4	4.64
10	4 1/4	2 1/2	4.50	2.69	6 3/4	3 1/4	6.75	3.21	4 1/2	4.96	4.25	5 1/2	3 1/4	5.40
11	5	3	5.25	3.20	7 7/8	3 7/8	7.87	3.84	5 1/4	5.77	5.00	6 3/8	3 7/8	6.30

*Minimum *C* and maximum *H* are same as maximum *d* for shank section.
†Minimum *W* for opening in planer or shaper toolpost is the same as minimum *W* for opening in lathe toolpost.

MACHINERY'S Data Sheet No. 190, New Series, November, 1930

Tungsten Carbide in General Motors Shops

At the Detroit Production Meeting of the Automotive Engineers, W. H. McCoy of the General Motors Corporation Reviewed the Results Obtained by the Use of Tungsten-carbide Tools

IN December, 1928, the General Motors Corporation placed a tungsten-carbide tool in one of its divisions where considerable trouble had been experienced in turning a die-cast ferrule having a chilled surface. The use of the tungsten-carbide tool for this turning operation increased the production per grind from 6 to 15,000 pieces! The speed of the machine was increased from 750 to 1400 revolutions per minute, which was the highest speed available. The results obtained on this job were responsible for the General Motors Corporation becoming interested in the new cutting material and its subsequent use for milling, turning, drilling, and boring operations.

Savings Made through the Use of the New Cutting Tools

A saving of $1450 per month was made by the application of the new cutting material to the finish-milling operation on an aluminum part. On this job, 1013 pieces were produced per grind with the tungsten-carbide cutter, as compared with 34 pieces for the tool previously used. The cutting speed of the tungsten-carbide cutter was 938 surface feet per minute, and the depth of cut 0.015 inch.

In finish-facing a cast-iron part on a lathe, the saving was $200 per month. The speed for this job was 196 surface feet per minute, and the depth of cut 0.032 inch. The tungsten-carbide tool, in this case, produced 15,000 pieces per grind, as compared with 1500 pieces for the best tool previously employed.

One of the jobs on which a tungsten-carbide tool was used consisted of rough-boring babbitt on a drilling machine; on this operation, a saving of $350 per month was obtained. The depth of cut in this case was 0.093 inch. About 40,000 pieces were rough-bored per grind with the tungsten-carbide tool, as compared with 400 pieces for the tool previously used. In boring a No. 32 bronze part at a speed of 157 surface feet per minute, the saving was $300 per month. In this case, 1064 pieces were produced per grind with the tungsten-carbide tool, as compared with 10 pieces for the tool previously employed.

In facing a flange on which the daily production is 2400 pieces, the cost per 100 pieces was $5.83, using a high-speed steel tool, as compared with $3.14, using a tungsten-carbide tool, which represents a saving of $1166.82 per month. Another part requiring facing, turning, and chamfering operations, on which the production is 200 pieces per day, had a machining cost of $15.28 per 100 pieces, using high-speed steel, as compared with $3.36 for the tungsten-carbide tool, which represented a saving of $452 per month.

A part produced at the rate of 500 pieces per day on which turning, facing, and chamfering operations are performed, cost $24.69 per 100 pieces for machining, using high-speed steel cutters, as compared with $8.37 for tungsten-carbide cutters. In this case, the saving resulting from the use of tungsten-carbide cutters amounts to $1589.60 per month.

Some Limitations of Tungsten-carbide Tools

Although the savings cited here are very impressive, certain characteristics of tungsten carbide make it impossible to obtain similar savings on all classes of work. For instance, very little success has been had in applying this material to twist drills. Also, tools used on automatic screw machines have failed in some cases, due to chipping, caused by repeated shocks or intermittent cutting.

As cemented tungsten-carbide tools have a higher heat conductivity than the material used for the shank, two things are likely to happen in machining a material that generates a great amount of heat; first, the shank becomes hot and expands away from the tip, breaking the bond; and second, there is a tendency for the chips and the excessively hot cemented tungsten carbide to alloy. The latter effect is particularly noticeable in cutting soft steel, but is not so marked in cutting steel within a Brinell hardness range of 220 to 260.

In cutting soft steel, a small fin appears on the cutting edge, and this breaks off, taking with it a small portion of the carbide tip. It is believed that this action occurs because the heat generated is sufficient to raise the temperature of the extreme cutting edge to a point where actual alloying takes place between the chip and the cutting edge. The resulting alloy is brittle and breaks off. This can be overcome by increasing the size of the tip to a point where the heat will be conducted away rapidly enough to prevent reaching alloying temperatures under ordinary working conditions.

Importance of Removing Strains in Tool Shanks

It has been found advisable to remove the strains in the tool shanks before mounting the tungsten-carbide tips. These strains should be removed after the recess for the tip has been machined. The strains are removed by packing the shank in a charcoal pot; it is then heated to approximately 1750 to 1800 degrees F. and allowed to cool slowly. This procedure seems to eliminate most of the difficulties experienced from the tips cracking after the bond is made. These cracks do not appear until the tips are finish-ground.

The size of the carbide particles cemented together by the metallic binder in tungsten-carbide materials is of the utmost importance when fine cutting edges are required. In the early tungsten carbide the grain size varied. Recently an effort has been made to control the size of these fine particles, and experiments indicate that such control will have a great effect on the hardness and strength of the product. One manufacturer has produced, experimentally, a cemented tungsten carbide having all the cemented particles of approximately the same size. Tests indicate that this material possesses a strength equal to that of hardened high-speed steel.

In the future, there will undoubtedly be many different grades of tungsten carbide, each grade being developed to suit a particular kind of work. Instead of the now common practice of finding a job to suit the tungsten carbide, we will then select the grade of tungsten carbide suitable for the job.

* * *

ENGINEERING AND TRADE ASSOCIATION MEETINGS

The seventeenth national convention of the Society of Industrial Engineers was held in Washington, D. C., October 15 to 17. Among the subjects discussed were: The present status of industrial engineering in college curricula; new aspects of the fatigue study of workers; elements in industrial stabilization; how the Federal Government is organized to help the industries; and the present status of time study and wage incentives.

The third annual convention of the Gray Iron Institute was held in Cleveland, October 8. Both technical and commercial problems of the foundry industry were considered. Dr. Zay Jeffries of the Aluminum Co. of America, the National Tube Co., and the General Electric Co., addressed the meeting on "How Research is Benefiting Industry." John S. King of King & Wiley, Inc., Cleveland, Ohio, spoke on "Modern Day Merchandising." Philip P. Gott, assistant manager of the trade association department of the Chamber of Commerce of the United States, made an address on "Consumer and Producer Both Profit Through the Trade Association." A discussion on "Reasons Why a Standard Cost System Should be Used" was led by A. C. Denison, president of the Fulton Foundry & Machine Co., Cleveland, Ohio. Arthur J. Tuscany, Terminal Tower Bldg., Cleveland, Ohio, is manager of the Institute.

ROY V. WRIGHT, NEW PRESIDENT OF THE A. S. M. E.

Roy V. Wright, managing editor of the *Railway Age,* has been elected president of the American Society of Mechanical Engineers for 1931. He will assume his duties at the annual meeting to be held in New York early in December. Mr. Wright was born in 1876. He was educated in the public schools of St. Paul, Minn., and at the University of Minnesota, where he received the degree of M. E. in 1898. Immediately upon graduation, he entered the locomotive erecting shop of the Chicago, Milwaukee & St. Paul Railway at South Minneapolis as a machinist's apprentice, later working as draftsman and chief draftsman. In 1901 he became mechanical engineer for the Pittsburgh & Lake Erie Railroad, and in 1904 associate editor of the *American Engineer and Railroad Journal.* In 1910 he became mechanical editor of the *Railway Age Gazette* which is now known as the *Railway Age.* The following year he was made managing editor of that publication, which position he still holds. Since 1910, he has acted as editor of various other publications issued by the Simmons-Boardman Publishing Co., publishers of the *Railway Age,* of which company he is a director and secretary. Mr. Wright has also been active in many civic enterprises.

Roy V. Wright, Newly Elected President of the American Society of Mechanical Engineers

Mr. Wright's election to the presidency of the American Society of Mechanical Engineers follows many years of active service in the affairs of the Society. He was a member of the Railroad Committee before the formation of the present Railroad Division, and he was also a member of the first Metropolitan Section Committee. He served as a manager of the Society from 1922 to 1925, and as a vice-president in 1926 and 1927. He has also served as a member of the Meetings and Programs Committee, and of many other important committees.

He was president of the United Engineering Society in 1928 and 1929. His contributions in papers and discussions have been an inspiration for better engineering. He is one of the contributors to the symposium "Toward Civilization," a book published last spring which may be considered a classic, expressing the philosophy of engineering.

Mr. Wright's early work brought him into direct contact with a varied line of engineering practice, and his duties as editor of a leading railroad publication have given him a broad vision and viewpoint on engineering problems in general.

Welding Practice at the Westinghouse Works

How Welders are Trained and How the Quality of their Work is being Maintained at a High Standard by Frequent Tests

IN a paper presented before the recent International Congress of Steel Construction at Liege, Belgium, by J. M. Hipple, works manager, and G. D. Fish, consulting structural engineer of the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co., the shop practice adopted at the Westinghouse plants to secure a high quality of weld was described briefly.

At this plant it is required that all welds be specified on the drawings in detail, showing the length and the amount of weld material to be laid down. An engineering process specification outlines in further detail the welding practice to be followed with reference to cleaning of the surfaces to be welded, size of welding electrode wire, wire-brushing the deposited layers, amount of peening, if any, and inspection.

The Training of Competent Welders

Both for hand and automatic welding, it is essential to develop skilled workers, as well as methods for checking their work. The application of welding is growing so rapidly that anyone making extensive use of it will find it advisable to establish a welding school or training department. Such a department may serve the dual purpose of developing workmen and of checking test pieces by the welders after they are in production work.

It has been found that young men having had some metal shop experience can be trained in from four to six weeks to produce uniformly dependable simple welds. During this period, their welds are given physical tests and are broken apart so that the welder gains a first-hand knowledge of the external and the internal appearance of good and bad welds. A minimum strength of 40,000 pounds per square inch is required before the welder is placed on production work. After going on production work, the welder is under the supervision of an instructor, in addition to the regular supervision, for a period of two months. After this, he is able to work independently, although he continues to acquire skill for a year or more.

Maintaining the Highest Degree of Care in Welding

For purposes of identification and with a view to encouraging the welder to take pride in his work, each welder is provided with a steel stencil with which he marks or autographs each weld that he makes. Skilled welders are used as inspectors, checking during the welding process the fusion with the parent metal, the preparation, size, and appearance as specified by the engineering specifications. At intervals, welds made by each operator are chipped out to observe the depth of fusion, amount of slag inclusion, and general appearance of the work.

Welders are required, at intervals of two months, to produce test pieces which are given physical tests; from the results the welders are graded. Any welder, whose test weld falls below a minimum requirement of 40,000 pounds per square inch, is either taken off the work or sent back to the school for further instruction.

With these relatively simple precautions and inspection methods, it is possible to undertake a welding program on any desired scale with complete assurance of satisfactory results. The experience of the Westinghouse company during the past several months, when a very large increase in production of welded structures has been handled, with a resultant need for a large increase in the number of welding operators, has been that the percentage of poor workmanship has been no higher than that in machining work, and there have been no cases whatever of weld failures after the shipment of apparatus from the factory.

Design Details to be Considered for Welded Structures

Most of the fillet welds are of the minimum size used for such sections—that is, 3/8 inch. Larger fillets than this are used only where the length available for the weld metal is not sufficient for strength. It is not usually necessary to use any fillet welds larger than 3/4 inch, but when it is, special attention is given to the welding procedure.

An arbitrary value of 10,000 pounds per square inch safe stress has been set for use in stationary parts with static loading, and 5000 pounds per square inch for all rotating parts. These conservative values have been used in view of the fact that the new process is revolutionary in its application, and when the development of the art progresses, the values for safe stresses can be increased.

Tendencies in the Design of Welded Structures

The earlier and even the present designs reflect to some extent the design engineers' previous work with castings and with riveted structures. As the new art develops further, there is no doubt that greatly improved practice will be adopted, and the engineer will think more clearly in terms of the possibilities of fabricated and welded structures, as such, rather than as something to take the place of a casting or riveted structure previously used.

The designs will be further simplified, using a smaller number of pieces, and no doubt the amount of welding will be reduced. The tendency has been to employ a large factor of safety in the welded joints by specifying an amount of welding that in all probability is excessive, and later practice will reduce this, based on further refinement of methods and more extensive field experience.

Present designs often call for the use of stiffener angles, welded at heel and toe, when a straight bar welded on both sides would be equally good; this merely reflects the engineer's experience with riveted structures where the angle would be necessary.

In some cases there has been an effort to copy the appearance of castings at a sacrifice of simplicity, instead of developing distinctive lines for the new construction. While the practice today is to produce rugged, adequate structures with a large factor of safety, the future will bring many developments in technique and in style. However, it is an outstanding fact that great economic advantages have already been secured through this new application of the combination of structural steel and welding.

* * *

AUTOMOTIVE PRODUCTION MEETING

Production managers and tool engineers in the automotive industries met in a well attended meeting of the Society of Automotive Engineers at Detroit, October 7 and 8. The papers read were well chosen to arouse the interest of those present, and were followed by discussions that added a great deal to the value of the meeting.

R. L. Templin, of the Aluminum Co. of America, spoke on "New Developments in Machining Aluminum and Its Alloys." This paper is abstracted on page 214 of this number of MACHINERY. W. H. McCoy, of the General Motors Corporation, read a paper entitled "The Future Development of Tungsten Carbide as a Cutting Tool" (see this number of MACHINERY, page 217). E. J. Bryant, of the Greenfield Tap & Die Corporation, spoke on "Wear Allowances and Tolerances on Gages" (see page 212). "Conveyors in the Automotive Industry" was the subject of a paper by J. H. Hough of the Mathews Conveyor Co.

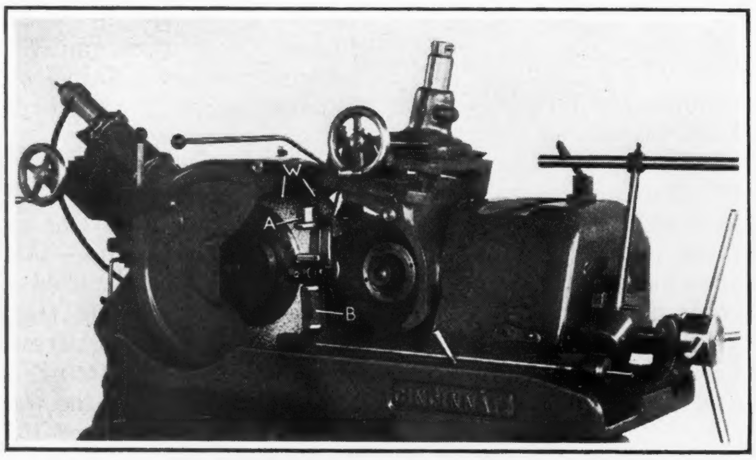
The economic side of production engineering and tool design was also covered. "The Effect of Time on Production Cost" was discussed by Professor Paul N. Lehoczky of the Ohio State University, and "The Tool Engineer's Place in Mass Production" was dealt with by O. B. Jones of the Detroit School of Applied Science.

A notable event in connection with the meeting was the S. A. E. Production dinner at which C. E. Wilson, vice-president of the General Motors Corporation, and Professor John Younger, of the Ohio State University, were the principal speakers. The Plymouth and Chevrolet plants were visited.

CENTERLESS GRINDING OF STEERING KNUCKLES WITH DUPLEX WHEELS

By the use of duplex wheels two cylindrical surfaces of a drop-forged steel steering knuckle are ground to different diameters simultaneously on the Cincinnati centerless grinder shown in the accompanying illustration. A double grinding wheel mount is used for the two wheels *W*, which are profiled to grind both surfaces in one cut by the in-feed method. Stock to the depth of 0.010 inch is removed from both surfaces by these two 20- by 1 1/2- by 12-inch, 60-M-28 Aloxite grinding wheels. The production rate with this equipment is 90 finish-ground pieces an hour, with the work held within limits of 0.0005 inch for size and 0.0003 inch for roundness and straightness.

The steering knuckle is placed on the special stepped work-supporting blade, as shown in the illustration, where it is held firmly in position by the overhead equalizing pressure shoe. As the work is unbalanced by the heavy arm *A*, the counterweight *B* is used to overcome this condition during the grinding operation. The operating mechanism for this job is located on the rear part of the work-rest and is so designed that the overhead pressure shoe is lowered and raised on each stroke of the in-feed lever, thus automatically clamping and releasing the piece.



Centerless Grinder Equipped for Grinding Two Cylindrical Surfaces Simultaneously

A spindle-reciprocating attachment with a hand-lever extending to the operator's side of the machine is provided for advancing the grinding wheel a slight amount at the end of each cut. This permits cleaning up the shoulder and fillet next to the ground cylindrical portion.

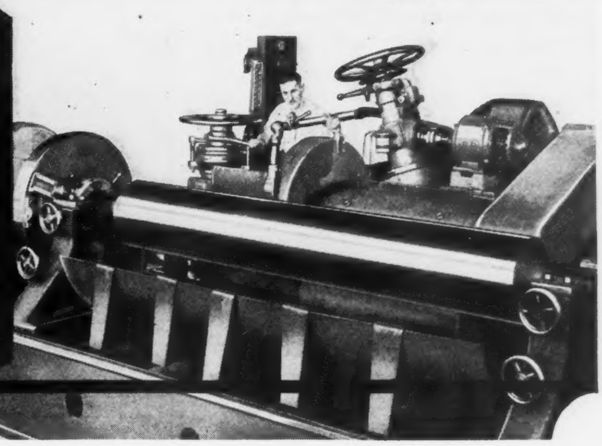
* * *

INDUSTRIAL MACHINERY IN ITALY

According to the Industrial Machinery Division of the Department of Commerce, both the imports and exports of Italy's foreign machinery trade in industrial machinery rose in 1929 above the two preceding years. The imports of industrial machinery and equipment in 1929 had a value of $34,000,000, while the exports were valued at nearly $10,000,000. The corresponding figures for 1928 were $27,000,000 and $8,500,000. The imports of machine tools from all countries into Italy increased from 6100 metric tons in 1928 to 8150 metric tons in 1929. Germany supplied the bulk of the machine tool imports, sending to Italy 5650 tons in 1929 compared with 3635 tons in 1928. The United States held second place, with France in the third position.

New Shop Equipment

Latest Developments in Metal-working Machines, Small Tools, and Work-handling Appliances

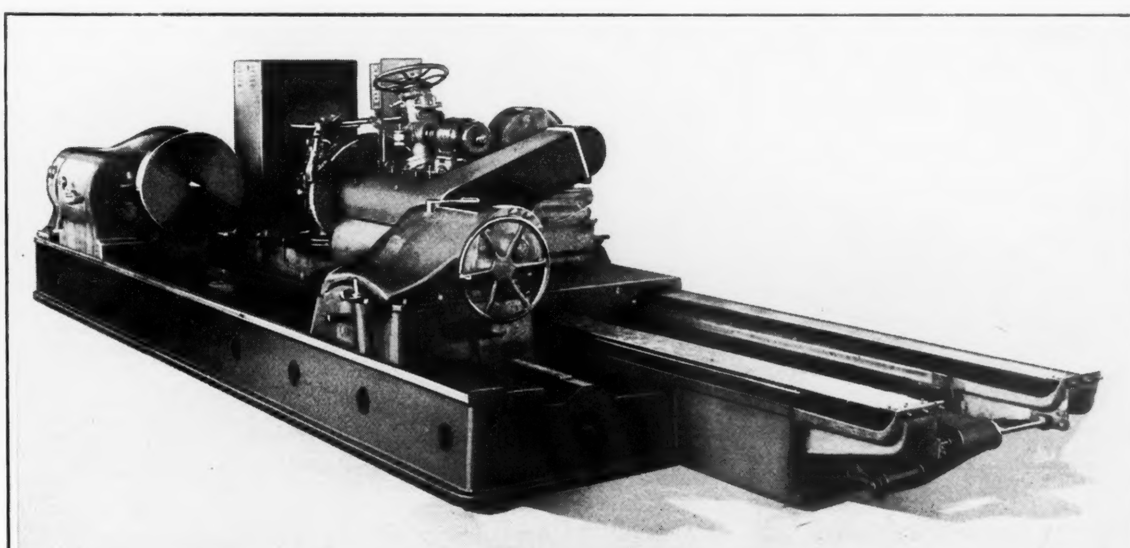


LANDIS ROLL-GRINDING MACHINE

Rolls for producing steel plate, cold or hot strip, bars, tin plate, nickel, aluminum, brass, and copper sheets, etc., may be ground and reground in a Type 30 roll-grinding machine recently developed by the Landis Tool Co., Waynesboro, Pa. The body of the rolls can be ground straight, concave, or crowned, and the roll necks can be trued up in the same machine. Three sizes of this machine are available, with swings of 36, 48, and 60 inches. Standard lengths range from 10 to 24 feet, and longer machines can be built special.

The front part of the bed supports the headstock, footstock, and roll-carrying heads. At the rear of the bed are bearing surfaces for a carriage on which are mounted the grinding-wheel head, crowning and concaving mechanism, traversing and reversing mechanism, operator's platform, and water pump. As the platform is located to the left of the grinding wheel (when the machine is viewed from the front), the operator has a full view of the contact point between the wheel and the work. All controls, both electric and otherwise, are located in convenient positions. Power for traversing the wheel carriage is supplied by a motor mounted on top of the carriage. Various traversing speeds are obtained almost entirely through a field rheostat. Reversals are accomplished electrically through a reversing controller which is brought into play by dogs. Various moving parts in the travers-ing mechanism are lubricated by a force-feed system, which also supplies lubricant to the carriage guides.

The grinding-wheel head is equipped with adjustable steel-back, babbitt bearings that are lubricated constantly. Multiple



Landis Machine for Grinding Large Rolls Straight, Concave, or Crowned

V-belts drive the grinding-wheel spindle from the right-hand end, power being supplied by a motor mounted on top of the base. The grinding wheel is fed through a screw and bronze half-nut. Provision is made for a rapid electric wheel-head cross-movement.

The headstock is equipped with an equalizing arrangement by means of which the roll is driven with equal pressure from diametrically opposite sides. Either the roll itself or a driving dog is engaged. When various sizes of rolls are handled, dogs can be furnished to take in the full range. Alignment of the footstock is maintained by means of a cross adjustment. Roll-carrying heads of the two-bearing type are usually furnished, but heads with three bearings are supplied when the rolls are light in weight.

The crowning and concaving mechanism is of a single eccentric type and receives power from the traversing motor. A chart aids the operator in selecting proper change-gears and in setting the roller of the crowning and concaving mechanism. This roller is carried on an adjustable slide equipped with a graduated scale that facilitates settings. There is a truing fixture mounted on the rear of the footstock for dressing the wheel face slightly convex, to suit the grinding of rolls with concave or crowned surfaces. Wheel faces can also be trued straight if desired. The water pump is of the impeller type and is driven by a vertical motor.

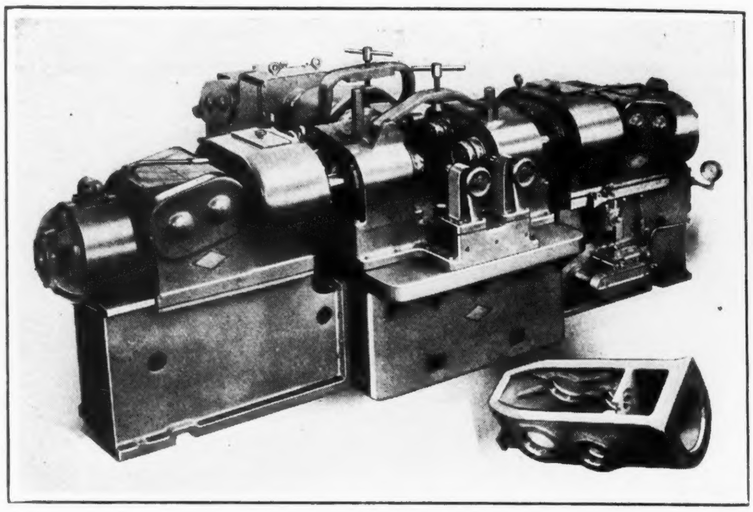


Fig. 2. Three-way Horizontal Machine Built for Rough- and Finish-boring Tractor Transmission Cases

ROCKFORD DRILLING AND BORING MACHINES

Three special machines recently built by the Rockford Drilling Machine Co., 209 Catherine St., Rockford, Ill., for performing heavy-duty drilling, boring, and similar operations on a high production basis are shown in the accompanying illustrations. In Fig. 1 are shown a double-end horizontal machine and fixture designed for core-drilling the crankshaft and camshaft bearings of automotive crankcases. Two extra spindle units, shown in front of the machine, are provided, together with another fixture, so that the machine can be used for two types of crankcases.

In Fig. 3 is shown a vertical machine equipped with a three-station indexing table for progressive operations on a large tractor gear-case housing. At the first station the fixture is loaded and unloaded; at the second station the hole through the hub is bored and the hub is rough-turned, faced, and counterbored; while at the third station, the hole in the hub is finish-bored, the hub is turned, and the large hole at the other end of the case is rough- and finish-bored.

A heavy-duty three-way horizontal machine designed for boring a large tractor transmission case is illustrated in Fig. 2. This machine rough- and finish-bores two cross-holes, 7 1/2 and 9 inches in diameter, on each side of the case, and at the same time rough- and finish-bores the large end hole which is 13 7/8 inches in diameter. Both the rough- and

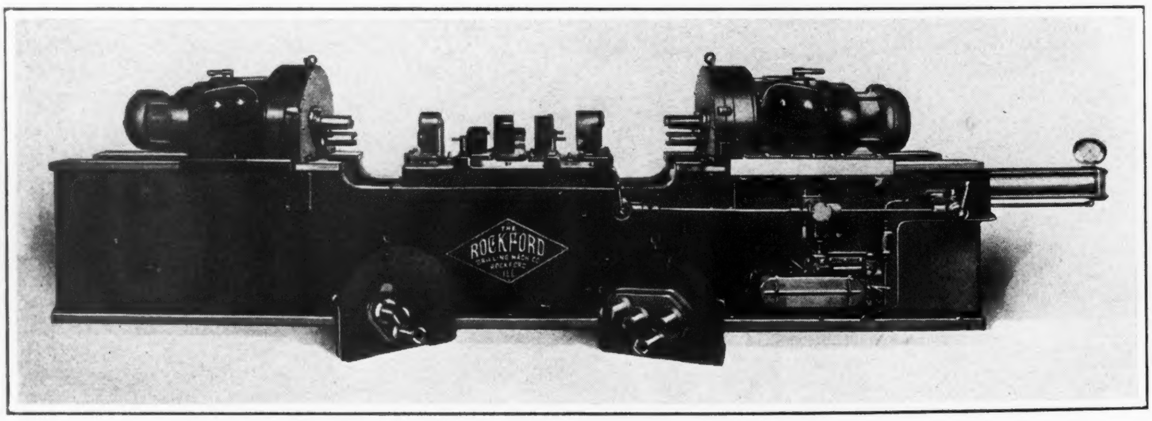


Fig. 1. Rockford Double-end Horizontal Machine Designed for Core-drilling Automotive Crankcases

finish-boring cuts are taken during one pass of the heads.

In all three machines, a motor is used for transmitting power to each drive head through two sets of worm-gearing and spur pick-off gears which are readily accessible. The heads can be operated at two different speeds by merely shifting a lever, and these speeds can be varied through the pick-off gears. All revolving parts in the drive heads are mounted in Timken tapered roller bearings.

The interchangeable spindle units are built separately to suit the individual job. The main driver of these units is connected with the spindle of the drive head. Feeding of the heads is accomplished through an Oilgear pump and cylinders. In some cases, only one pump is used to operate several heads simultaneously, and in other instances there is a separate pump for each head.

Special arrangements of the control system permit full automatic operation of the machines. For example, after the operator has engaged the control lever of the machine illustrated in Fig. 3, the head moves downward at the rapid traverse rate to a point where the tools are about to start working; then the head continues at the feeding rate to a predetermined point; next it slows down to a finer feed for the facing cut, dwells for a short time against a positive stop, and, finally, traverses rapidly to the starting position.

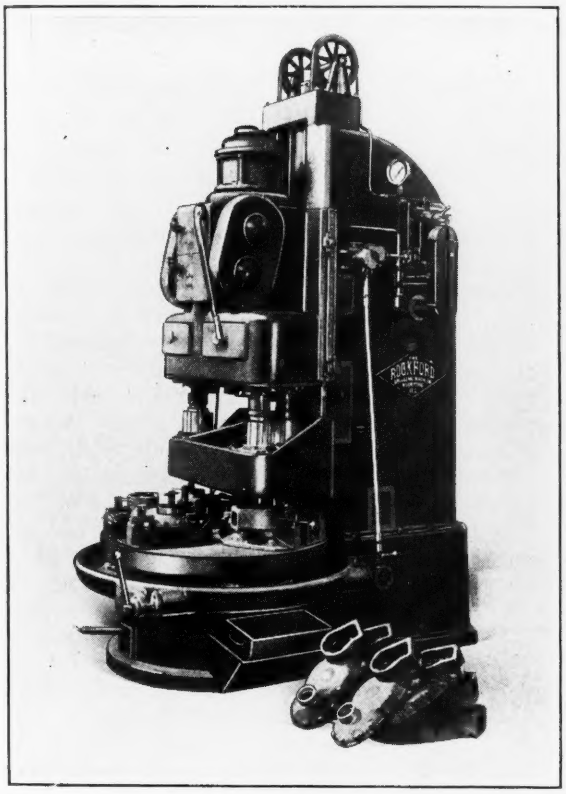
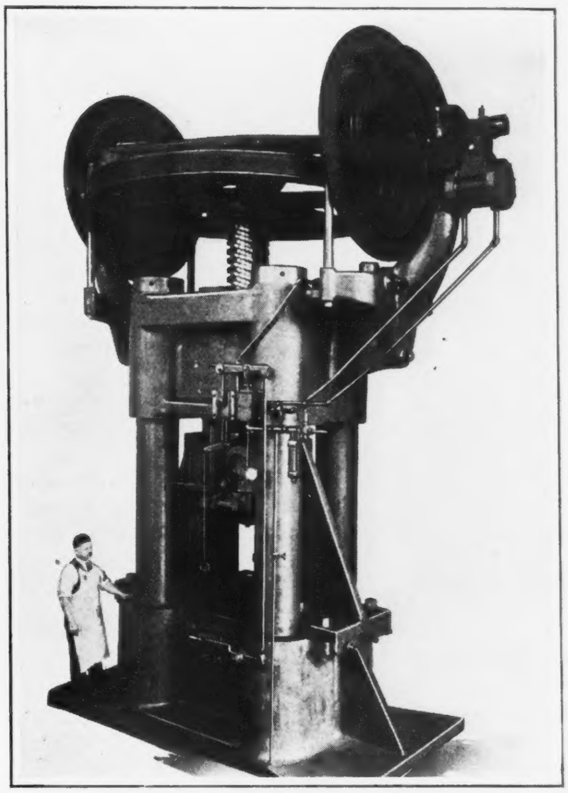


Fig. 3. Vertical Machine for Boring, Turning, and Facing Gear-case Housings

ZEH & HAHNEMANN PERCUSSION POWER PRESS

A percussion power press having a weight of 85 tons, which is the largest machine of this type ever constructed by the Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J., is shown in the accompanying illustration. This press has an overall height of 22 feet and requires 75 horsepower for its operation. The frame is of the four-pillar built-up type. The main screw measures 16 inches in diameter, is made of tool steel, and is heat-treated. The flywheel is a steel casting 120 inches in diameter, weighing four tons. It travels at a circumferential speed of 26 miles per hour.

This press is operated to yield normally a pressure of 900 tons. It is controlled pneumatically, reversing automatically at the end of the down stroke and stopping in the upper position. The maximum stroke is 25 inches, and ten full strokes can be made per minute. An emergency brake stops the flywheel promptly in case the press is tripped while empty; otherwise, the flywheel would strike the top of the frame and cause damage.



Zeh & Hahnemann Percussion Power Press which Weighs Eighty-five Tons

GREASE FOR MOTOR LUBRICATION

The General Electric Co., Schenectady, N. Y., has placed on the market a grease intended for lubricating ball- and roller-bearing motors. This lubricant

is being used for ball bearing applications with speeds as high as 25,000 revolutions per minute, and in temperatures ranging from — 25 to 250 degrees F.

It is claimed that the new lubricant maintains an operating consistency under severe conditions and over as wide a temperature range as will be encountered in service; allows complete ball and roller motion; possesses little tendency to gum-cake or separate; contains no free acid or water; will not turn rancid; and has unusual film strength to withstand severe thrusts and heavy bearing loads. This lubricant is supplied in two-ounce tubes and one-pound cans.

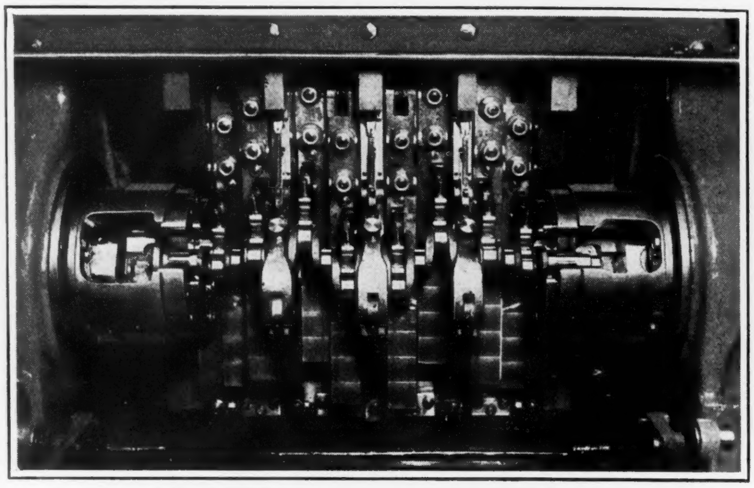


Fig. 2. Close-up View of the Work, Chucks, and Tools

LE BLOND AUTOMATIC CRANKPIN FINISH-TURNING LATHE

With a view to eliminating the rough-grinding operation on the pin bearings of automobile crankshafts, the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, has developed the automatic machine here illustrated, which finish-turns the pins and faces the side walls. About 0.020 inch of stock is left on the diameter of the pins and 0.0035 inch on each side to be removed by finish-grinding. This machine resembles in general appearance the one described in January, 1929, MACHINERY, page 384, but there are many differences in design. It has a weight of about 45,000 pounds.

Owing to the orbital motion required, two master crankshafts are geared together with the spindle. These crankshafts are connected with a carrier, on the front face of which the toolblock is mounted. The master crankshafts are so positioned in relation to the spindle that the cutting compound, chips, and dirt cannot get into the various bearings. The lower master crankshaft is located in a base compartment where it receives continuous lubrication, while the upper one is carried in a cradle that pivots at the center of the driving intermediate gear. The tool-carrier members are connected to the upper master crankshaft by short rods, and the feeding movement of the tools is controlled by the motion imparted to the cradle.

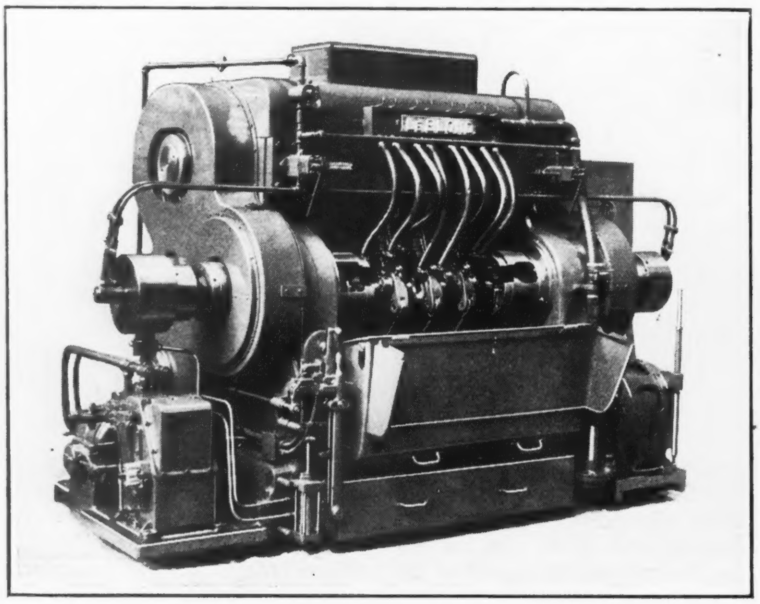


Fig. 1. LeBlond Automatic Machine for Finish-turning the Pins of Automobile Crankshafts

The cradle is actuated by a hydraulic cylinder through a rack, gear, and toggle motion. This cylinder is located in a compartment in the center of the machine and is operated by an Oilgear pump driven by a five-horsepower motor. With the toggle feed arrangement, the speed of the tools automatically decreases as they near the pins. This gives a large displacement of oil in the cylinder and a powerful feed. At the completion of the cut, the cradle is traversed rapidly to its starting position.

The crankshaft to be machined is driven at both the flange and stub ends by chucks operated through tandem air cylinders. To enable the work to be loaded rapidly, the front part of each chuck is so constructed that the operator just places the crankshaft in the guide opening and it slides into position. The machine cannot be started unless

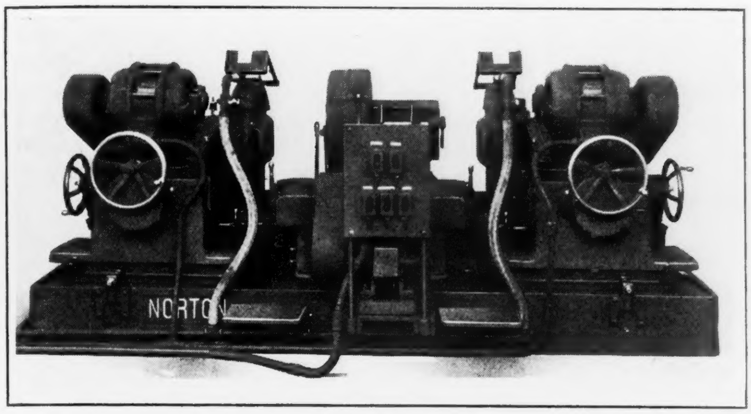


Fig. 1. Norton Car-wheel Grinding Machine from Operating Side

the work is chucked properly. Three work-supports are used with an eight-cylinder crank-shaft. Automatic forced-feed lubrication is supplied to all bearings, and a 25-horsepower motor is used for driving the machine.

NORTON IMPROVED CAR-WHEEL GRINDING MACHINE

Improvements have been incorporated in a car-wheel grinding machine just brought out by the Norton Co., Worcester, Mass., to replace the older model that has been used by railroads during the last twenty-five years. The method of grinding in the new machine, as in the old, is in accordance with the recommendations of the American Railway Association. The wheels are ground while revolving on their own journals. New wheels are ground to insure concentricity and smooth running, while wheels that have been in service are ground to remove flat spots.

The machine is equipped for grinding car wheels up to 44 inches in diameter and engine-truck wheels up to 36 inches in diameter. The minimum wheel diameter that can be ground is 20 inches. Only standard wheel mountings of 4-foot 8 1/2-inch gage can be accommodated on this machine.

The arrangement of the work supports is optional. Those shown in the illustrations are for standard axles with journals from 3 to 9 inches in diameter. The supports are adjustable for height by means of handwheels. Endwise shifting of the axle is prevented by adjustable ball thrust bearings. When required, supports for ball- or roller-bearing axles can be supplied.

Two complete grinding-wheel units are employed, one for each wheel. These units are motor-driven and controlled individually. The grinding wheels are fed by handwheels on ball-bearing-mounted feed-screws and there are handwheels on the sides of the machine for aligning the grinding wheels relative to the work. Each slide is reciprocated independently by power from 5/8 to 1 1/8 inches. Two traversing or reciprocating speeds are available.

The five motors of the machine are all controlled from push-button stations conveniently located, as illustrated in Fig. 1. There is an auxiliary push-button station on the opposite or loading side of the machine (see Fig. 2) for starting, stopping, or jogging the work drive while loading or unloading. The net weight of the machine, including the motors, is approximately 35,000 pounds.

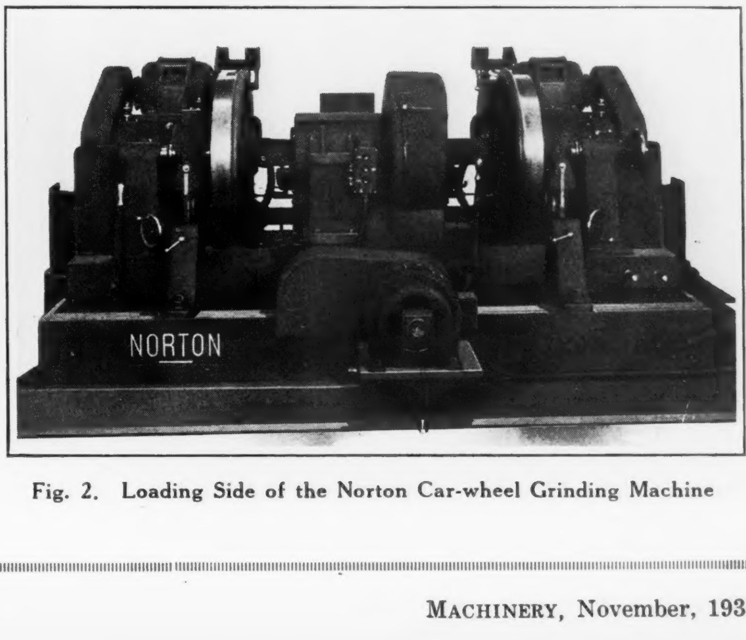
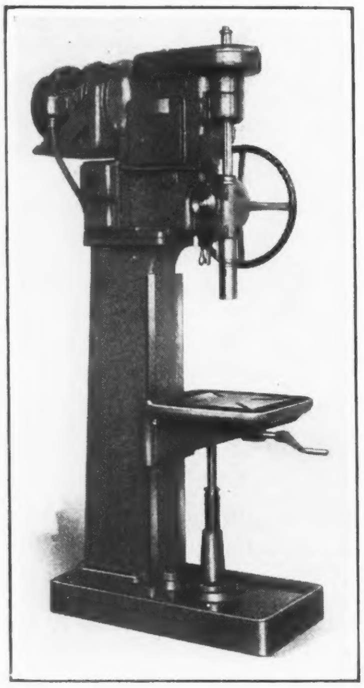


Fig. 2. Loading Side of the Norton Car-wheel Grinding Machine

BARNES DRILL CO.'S DRILLING AND TAPPING MACHINE

A self-oiling, all-geared drilling and tapping machine designed for operation in production service at one speed and one feed is the latest addition to the line of machine tools built by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. This machine has a capacity for drilling up to 1 inch in mild steel, and has a swing of 20 inches.

Through the use of pick-up gears, any spindle speed from 69 to 1296 revolutions per minute is obtainable, to suit the use of high-speed twist drills from 3/8 to 1 inch operating at their maximum working speed in any material. Likewise, a wide range of feeds is obtainable through pick-up gears to suit the size of drill or other tool employed. Feeds to suit the pitch of taps may also be provided. The shafts of the pick-up gears are mounted in Timken tapered roller bearings.



Production-type Drilling and Tapping Machine Built by the Barnes Drill Co.

The motor may be of the flanged type for mounting direct upon a section of the frame as illustrated, but a flanged bracket can be provided to suit the application of a standard foot-type motor. A three-horsepower motor running at 1200 revolutions per minute is recommended by the manufacturer. A single-pulley one-quarter-turn drive can also be supplied.

For tapping operations, a reversing multiple disk clutch gear is provided. There is a safety device for the feed which prevents overloading and minimizes the breakage of twist drills. The maximum distance from the regular table to the nose of the spindle is 37 1/2 inches, and from the base to the spindle nose, 47 3/4 inches. The spindle has a travel of 10 inches. The net weight of the machine, with a three-horsepower motor and starter, is 1220 pounds.

GENERAL ELECTRIC BRAKES FOR MOTORS

A line of band-type clapper magnet-operated brakes for direct-current motors has been placed on the market by the General Electric Co., Schenectady, N. Y. These brakes are intended primarily for heavy-duty service in connection with the operation of cranes and hoists, and for similar applications. They operate in the same manner as the external contracting-band type of automobile brake. They are applied by a spring, released by a magnet, and can be connected to operate in synchronism with the starting and stopping of the motor or to operate independently.

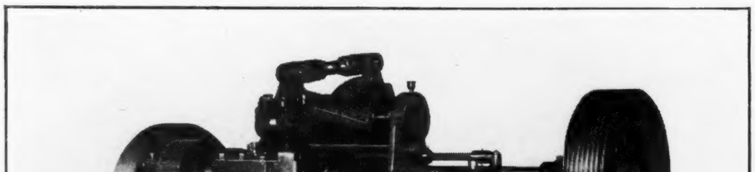
BLISS SHEET-METAL TRIMMER

A new type of machine has recently been developed by the E. W. Bliss Co., Brooklyn, N. Y., for trimming symmetrical boxes or containers made from brass or mild steel. The illustration shows the machine and two trimmed boxes measuring 6 inches wide by 10 inches long. Stock up to 3/32 inch thick can be trimmed and the machine will handle shells measuring 20 inches across corners and 6 inches deep. The smallest sized shells that can be trimmed on this machine are 4 1/2 inches in width and 1 inch in diameter.

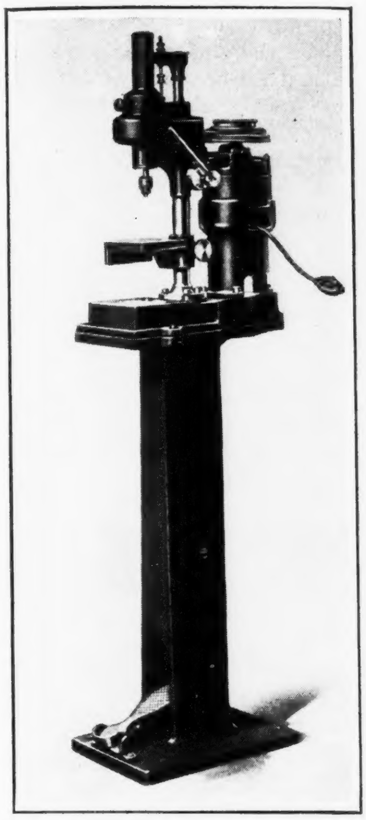
The machine is arranged with a positive rolling key clutch, and the gearing is such that the shaft that actuates the trimming cam rotates once while the chuck spindle revolves one and a half times. It is necessary that the shells or boxes to be trimmed be symmetrical in shape, as the starting point is the same every other time that a shell is to be trimmed.

The upper cutter is mounted on a rocker arm and runs in roller bearings, the rocker arm being operated by a follow cam which conforms to the contour of the article to be trimmed. A separate cam is required for each shape.

When the operator places an untrimmed shell on the chuck and locks it in position by means of the tail-spindle, he trips the clutch and the machine trims the shell. The machine also cuts the scrap in two places, the scrap falling through an opening in the bed. The operator releases the trimmed piece by unlocking the tail-spindle and bringing it to an extreme back position, thereby engaging a rod which is connected with a knock-out rod that extends through the center of the chuck spindle. The trimmed box also falls through an opening in the bed and can be carried away by means of a belt or chute. From five to ten shells can be trimmed per minute.



Bliss Equipment for Trimming Boxes Made of Brass or Mild Steel



High-speed Drilling Machine with Pedestal Mounting

HIGH-SPEED PEDESTAL-TYPE DRILLING MACHINE

The Model R-53 high-speed sensitive drilling machine built by the High Speed Hammer Co., Inc., 305-321 Norton St., Rochester, N. Y., which was described in August, 1929, MACHINERY, page 949, is now obtainable with the pedestal mounting illustrated. This equipment is provided with a foot-treadle for the convenience of the operator when it is necessary to employ both hands in the manipulation of work. The three-speed pulley combination is designed for spindle speeds of 1500, 3000, and 6000 revolutions per minute.

DE VLIEG DUPLEX "SUPERMIL"

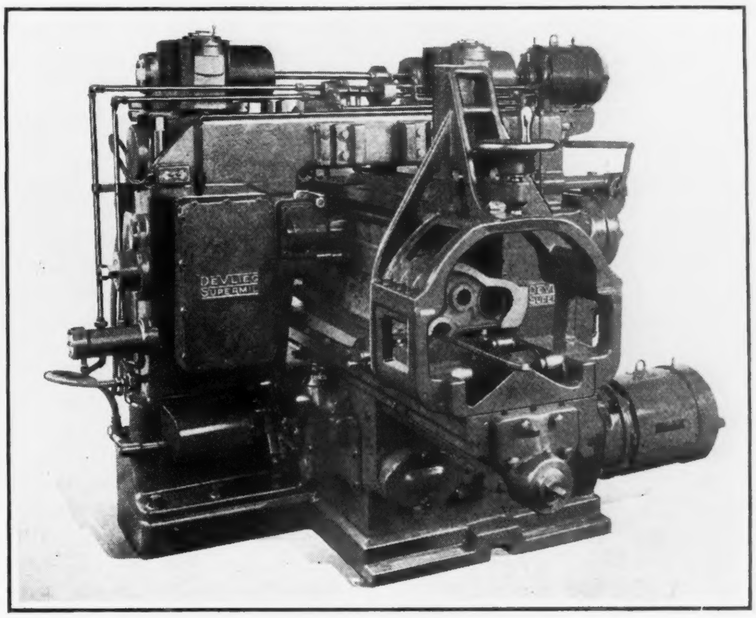
Fixed and automatically disappearing spindles are one of the features of a duplex "Supermil" recently built by the DeVlieg Machine Tool Co., Jackson, Mich. The arrangement facilitates milling, in approximately the same plane, bosses of different heights, separated by ribs and other projections on the work. In this machine, there is an automatic coordination of vertical and table feeds which gives a "U-shaped" cycle. The machine is equipped with tunnel-type fixtures that join a conveyor line and thus avoid the need for overhead handling means. The construction of the machine and the speeds provided suit the use of Carboloy cutters.

The particular machine illustrated is equipped for handling an eight-cylinder automobile engine block which has the crankcase half and bell ends cast integral. On this block there are two major pads on the upper portion which are milled with fixed cutter-spindles on each side. Below these surfaces are a number of small pads and bosses on each side of the crankcase which are separated by projections on the casting. On one side of the crankcase there is a second row of bosses behind an interfering projection that are at a different height from those machined during the first half of the machine cycle.

The entire cycle of the machine is controlled automatically. For the vertical movement there is a motor-driven pair of feed units, each of which employs a hardened and ground screw, the same as the main table. The disappearing spindles are actuated by hydraulic cylinders which are entirely controlled by cams mounted on the top rail of the fixture.

The operation cycle starts with the loading side of the table advanced to the conveyor. After an engine block has been rolled into position against an approximate locator, the movement of a lever drops the rolls, allowing the block to rest on hardened plates, and simultaneously registers locating plugs in two holes in the block. Clamping is effected by handwheels at the end of the fixture, but air clamps can be supplied for operation from one end.

With the block in position, one of the feed-levers is engaged to start the vertical-movement motor for feeding both heads down to the lower position, after which the table feed is engaged automatically for milling longitudinally. Upon completion of the longitudinal portion of the cycle, the table feed trips out and again starts the vertical motor to lift the heads into the upper position and thus complete the milling cycle. After the clamps have been released, the locating plugs drop simultaneously with the



DeVlieg "Supermil" with Both Fixed and Automatically Disappearing Spindles

raising of the rolls and the block is slid on the conveyor at the opposite side of the machine. The operator then engages the power rapid traverse to return the table to the starting position.

The Carboloy cutters used run at the rate of 300 feet per minute, and a feed of 25 inches per minute is employed. The production is twenty-five finished blocks per hour.

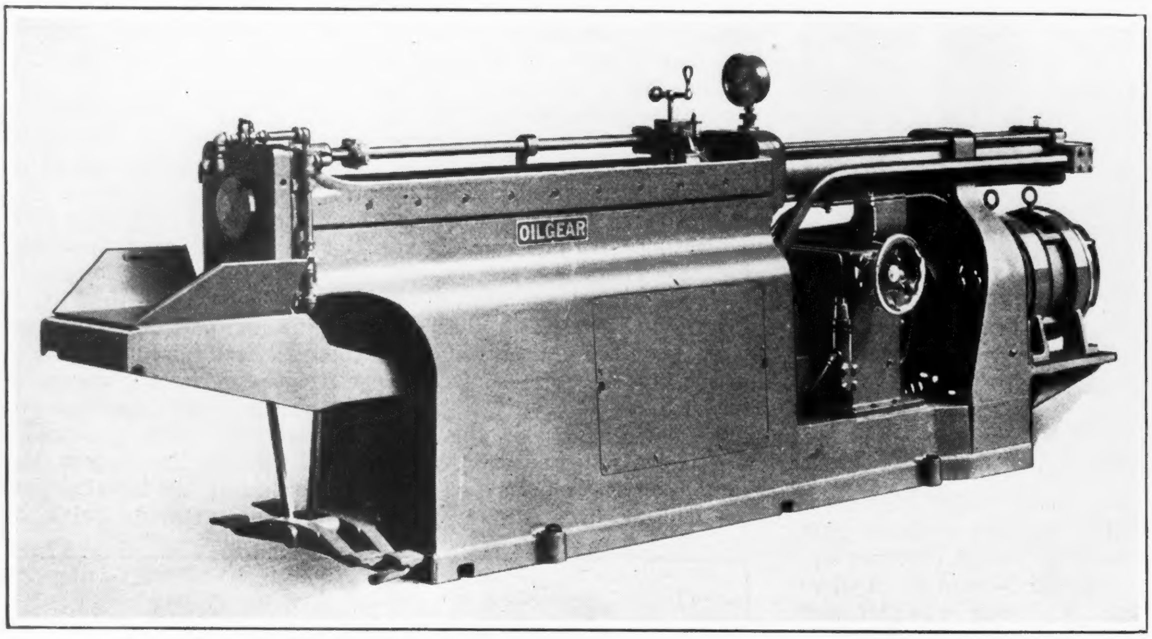
OILGEAR HORIZONTAL BROACHING MACHINE

A Type XL-12 horizontal hydraulically operated machine designed for the high-speed broaching of small and medium-sized parts is the latest development of the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis. The pulling speed of this machine varies from 4 to 33 feet per minute, while the maximum return speed is 70 feet per minute.

The power unit consists of a variable delivery pump which is mounted in the frame as an integral part of the machine. The pump is operated at a maximum speed of 860 revolutions per minute, and has a maximum delivery of 4800 cubic inches of oil per minute at a maximum working pressure of 1000 pounds per square inch. The pump, broaching machine, work, and tools are protected against overloads by automatically operated relief and by-pass valves. The amount of oil delivered and the speed of the draw-head are controlled through a convenient handwheel on the pump.

The control mechanism of the machine proper consists of a simple hand-lever and a double foot-pedal for starting and reversing the draw-head. The draw-head can be stopped and started instantly at any point of its stroke. Two adjustable cams stop the head at the end of the stroke.

The draw-head can be adjusted 1 3/8 inches above or below the center line of the ram. Other important specifications of the machine are as follows: Normal pulling capacity, 12,000 pounds; peak pulling capacity, 15,000 pounds; maximum stroke, 48 inches; and weight of machine, approximately 3600 pounds. The machine is driven by a 10-horsepower motor running at 860 revolutions per minute. Special equipment includes a sliding broach support and a broach clamping fixture.



Oilgear High-speed Broaching Machine for Small and Medium Sized Parts

CINCINNATI NO. 2 MILLING MACHINE

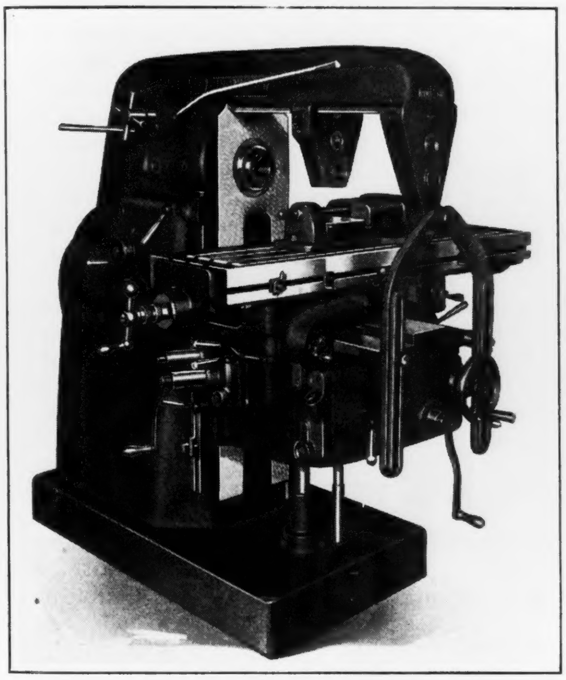
A "New No. 2" milling machine of the knee and column type is being placed on the market by the Cincinnati Milling Machine Co., Cincinnati, Ohio, in plain, universal, and vertical styles. This machine has the same general characteristics as the No. 3 machine described in November, 1929, MACHINERY, page 240, and the No. 4 machine described in the May, 1930, number, page 733.

Sixteen spindle speeds ranging from 20 to 500 revolutions per minute are obtainable, and sixteen table feeds ranging from 1 to 20 inches per minute (low and high series) are also available. Both speeds and feeds are changed by means of an automatic power shift mechanism controlled from either the front or the rear of the machine. In changing speeds from the front, the operator first shifts the lever at the front of the saddle to the left, while the starting lever is in the stopped position, until the desired speed on the upper revolving dial appears opposite the arrow. Then the speed rate is obtained by engaging the starting lever.

To change feeds, the same lever as is used for selecting speeds is shifted in the opposite direction until the desired feed on the lower revolving dial appears opposite the arrow. Complete control from the front or rear of all power and hand feeds, including power quick traverse, is another feature. In other words, there are independent directional control levers for the cross, vertical, and longitudinal movements of the table, in or out, up or down, and right or left. There is a power rapid traverse for each of these movements with the spindle stopped or running.

The column mechanism, including the entire spindle drive and speed and feed shifting mechanisms, is automatically lubricated by a geared pump inside the column. Automatic lubrication is also provided for the knee, while the "one-shot" system is used for the saddle and table ways. Anti-friction bearings are supplied throughout the spindle drive. A cutter coolant pump having a capacity of 8 gallons per minute is provided.

The vertical machine has the same general features as the plain or universal millers. It embodies a vertical spindle which is mounted in a head that may be solidly clamped to the machine frame. This head can be adjusted by loosening screws, and may be provided with a hand or power feed.



Cincinnati "New No. 2" Milling Machine Built in Both Plain and Universal Styles

EX-CELL-O HYDRAULIC DIAMOND BORING MACHINE

Tungsten-carbide tools and diamonds may be used in a machine recently developed by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., for the precision boring of automobile pistons, connecting-rods, and similar work. Both rough- and finish-boring can be accomplished at a single loading of the work and by the use of one work fixture. The illustrations show the machine arranged for simultaneously rough- and finish-boring three pistons. There are three spindles at one end of the machine for carrying the roughing tools, and three spindles at the opposite end for the finishing tools.

A fully hydraulic fixture is employed for holding the pistons, which is operated directly from the hydraulic unit on the machine proper. Upon the completion of the operating cycle, the fixture stops in the middle of the machine. Then, by turning the hydraulic control crank seen at the front in Fig. 1, the hinged cover which carries the clamping mechanism is automatically opened and the pistons are partially ejected from their seats.

When new pistons have been placed in the fixture, the hydraulic control crank is again turned, closing the hinged cover and moving equalizers into position for aligning the pistons for the rough-boring operation. The clamping mechanism in the top of the cover fastens the pistons securely in place. As soon as this locking operation has been finished, the equalizers are withdrawn and the table is started automatically. The table first moves the fixture to the roughing position, and when the roughing operation has been finished, it returns to the opposite side for finish-boring. Finally, the table is returned to the center of the machine, where it is stopped automatically.

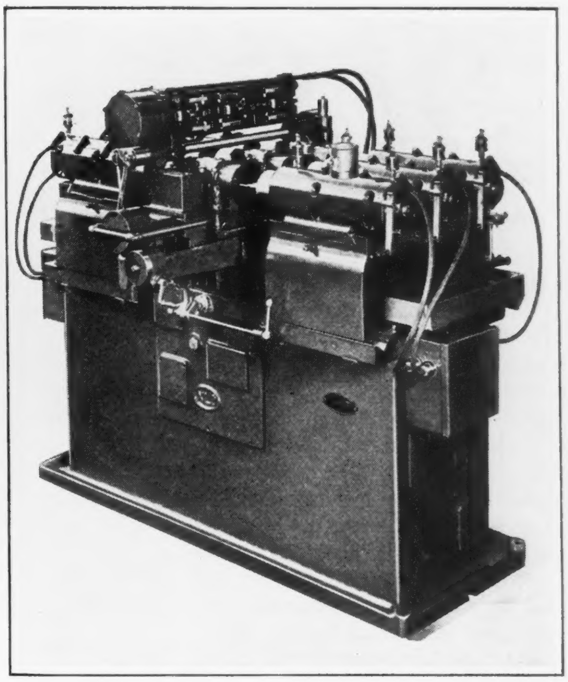


Fig. 1. Ex-Cell-O Boring Machine Designed to Use Diamonds or Tungsten-carbide Tools

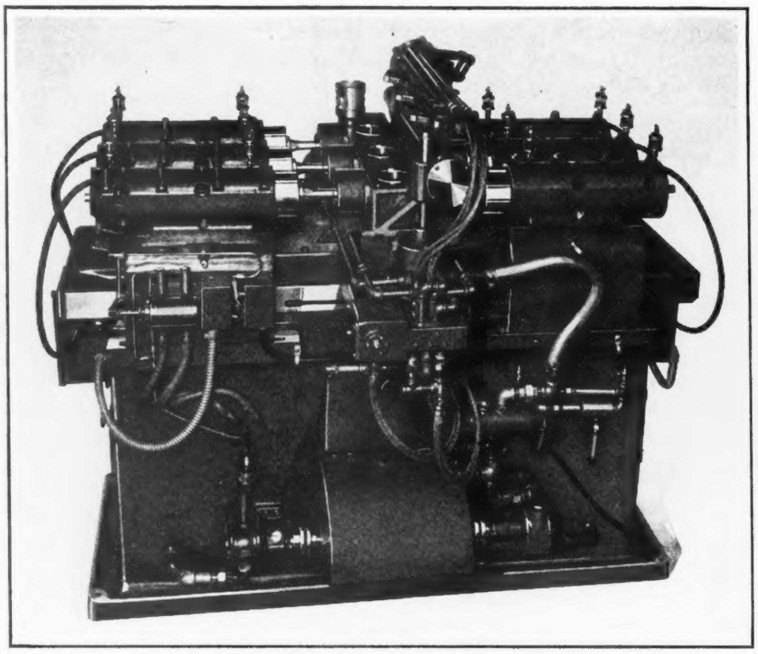


Fig. 2. Rear View of Ex-Cell-O Six-spindle Machine, which Rough- and Finish-bores Three Pistons in One Operation

The table has a maximum stroke of 16 inches. It is actuated hydraulically through a feed cylinder clamped to the bottom. The table weighs approximately 900 pounds and slides on wide accurate surfaces. The hydraulic system and valves were specially developed by the concern. Speeds and feeds may be changed quickly, and any operating program can be obtained by properly positioning the fast-speed, slow-speed, and table-reversing dogs.

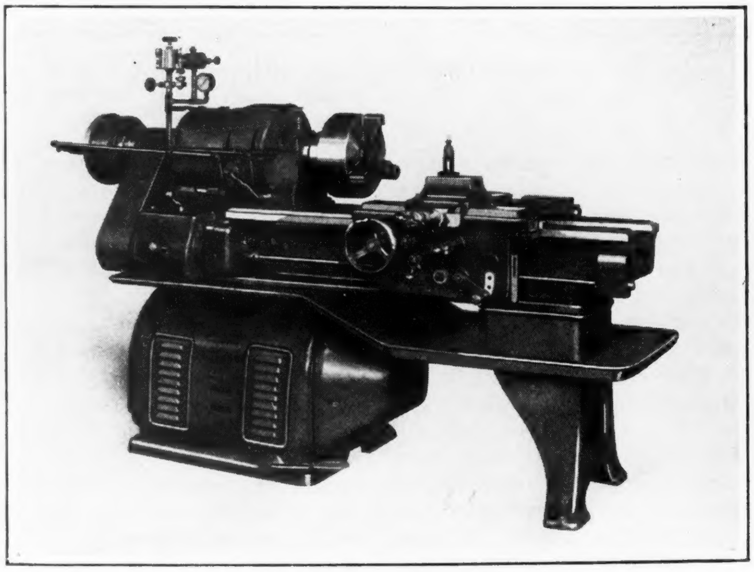
Each boring spindle is driven individually by a 3/4-horsepower motor running at 3600 revolutions per minute. Spare spindles with boring tools set to size may be quickly interchanged. The spindles on each bridge are equipped with limit switches and individual brakes that are operated hydraulically. These brakes are applied to stop the spindles when the cut has been completed and the table is ready for the reverse movement.

MONARCH HIGH-SPEED LATHE

Spindle speeds up to 3000 revolutions per minute are obtainable with a Model AA high-speed lathe recently developed by the Monarch Machine Tool Co., Sidney, Ohio. This 16-inch by 6-foot machine is equipped with Timken tapered roller bearings throughout. Automatic length feed stops are another feature. Any type of tool equipment can be provided, including an automatic facing attachment, multiple tool-rests, etc. This lathe has been designed for handling such pieces as can be most economically machined at a high rate of speed with tungsten-carbide tools.

Either a direct-current variable-speed motor or an alternating-current multiple-speed motor can be mounted in the large cabinet base. Multiple V-belts running up between the walls of the bed transmit the drive direct to the spindle. The bed walls are far enough apart so that the V-belts clear without the use of idler pulleys. Power is transmitted from the spindle to the quick-change feed-box through a silent chain or multiple V-belts.

The bed of this lathe is made of carbon eutectic steel, which is so-called because it contains only from 2.60 to 2.70 per cent carbon. This material has a tensile strength of from 55,000 to 60,000 pounds per square inch and can be machined to a steel-like bearing surface.



Monarch Lathe which can be Run at Speeds up to 3000 Revolutions per Minute to Suit the Use of Tungsten-carbide Tools

GLEASON GEAR TESTING MACHINE

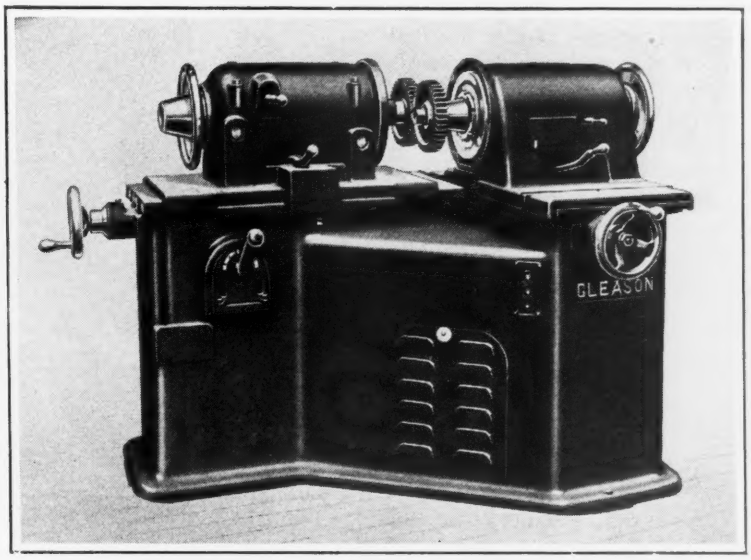
Spur, helical, and herringbone gears can be tested for running qualities in a machine recently brought out by the Gleason Works, 1000 University Ave., Rochester, N. Y. Gears of the

internal type, of the cluster style, or with an integral shank can be handled. The machine accommodates gears up to 14 1/2 inches pitch diameter. The gears are tested by running them together in pairs or by running several gears successively with a test pinion. They can be tested with or without a load, the load being applied manually by means of a brake that operates on the driven spindle.

The work-heads are adjustable horizontally on the frame through a handwheel and lead-screw graduated to 0.001 inch. Both heads are locked to the frame at the front and rear by separate clamps which are operated with equal tension through one lever. The spindles are mounted in ball bearings, and are driven by a five-horsepower motor located in the base. An outboard support is furnished for use with gears having a long shank. This support is bolted directly to the frame; however, an over-arm type of support can also be furnished.

If it is desired to run gears together with a mild abrasive for removing any slight roughness produced during the heat-treatment, guards, a pump, a sump and a motor can be obtained as extra equipment.

Some of the important specifications of the machine are as follows: Minimum and maximum distances between the spindle noses, 3 and 18 inches, respectively; minimum and maximum center-to-center distances between spindles, 3 and 10 inches, respectively (with the way guards removed, the minimum distance is zero); maximum distance between the adjustable tail-center and the nose of the brake-head spindle, 14 1/2 inches; and net weight of machine, 4000 pounds.



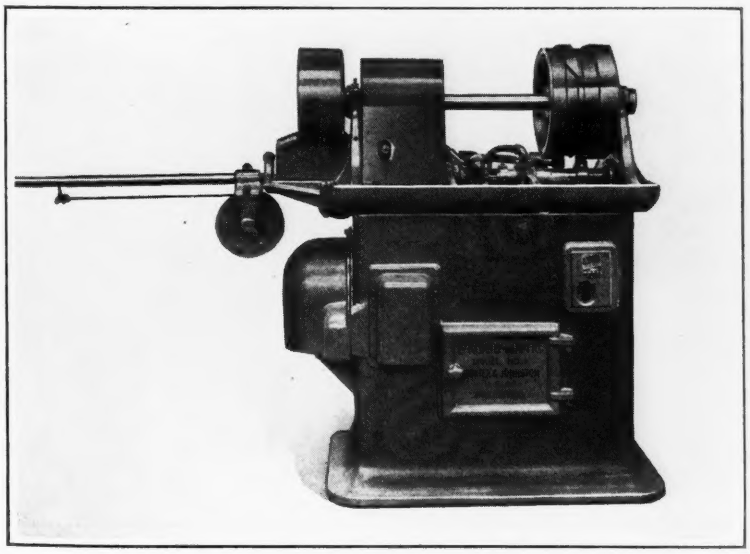
Gleason Machine for Testing the Running Qualities of Gears

"EKONOMATIC" NUT MACHINE

Nuts ranging in size from 1/4 to 1/2 inch and of either plain or castellated styles can be produced in the Model No. 1 "Ekonomatic" nut machine recently placed on the market by the Potter & Johnston Machine Co., Pawtucket, R. I. The main spindle will handle hexagonal bars up to 7/8 inch across flats and round stock up to 1 inch. A two-horsepower motor installed in the base supplies ample power for all requirements. The base of the machine is 3 1/2 feet long by 2 feet wide.

Through the use of a cut-off tool 1/16 inch wide and a stock-feeding mechanism that carries the bar completely through the spindle to the gripping surface of the collet, wastage of stock is held to a minimum. The bar is fed into the working position by means of a mechanism that employs a long heavy coil spring contained within the feeding cable pulley. Mounted on the camshaft directly over the spindle, there is a swing arm on which are cams that engage and disengage the collet at the proper point in the machine cycle.

The collet is of the drawback type, and is connected to the rear of the spindle by means of a tube on the end of which there is a collar. Drawing back of the collet is accomplished through



Potter & Johnston Machine for Producing Plain or Castellated Nuts

the compression of fingers. The operation of the center tool bar and of the double-action swing arm which carries the cut-off and forming tools is closely timed.

Only three cams are required, one for the feed and return of the center tool bar, one for operating the double-action swing arm, and the simple permanent cam for operating the collet. Any desired spindle speed is obtainable by changing the motor sprocket.

HISEY IMPROVED FLOOR-STAND GRINDERS

Floor-stand grinders of an improved design are being placed on the market by the Hisey-Wolf Machine Co., Cincinnati, Ohio, in 5-, 7 1/2-, and 10-horsepower sizes to supersede previous models. These new grinders are equipped with adjustable steel-plate guards and heavy steel tool-grinding rests which are adjustable and removable. There is a larger door than formerly to provide access to the motor starter. A larger spindle and larger bearings are also provided. All feed wires are protected by being encased in a flexible metal conduit.

The 5-horsepower grinder is provided with an 18- by 3-inch wheel; the 7 1/2-horsepower grinder, with a 20- by 4-inch wheel; and the 10-horsepower grinder, with a 24- by 4-inch wheel. The weights of the different sizes range from 1650 to 2000 pounds.

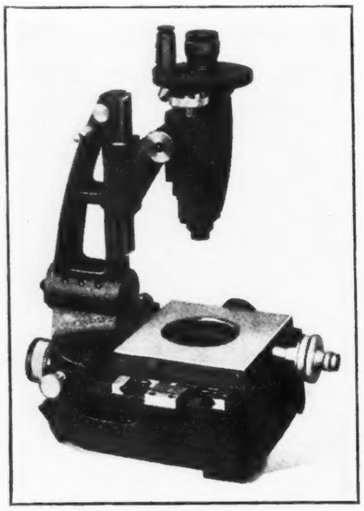


Fig. 1. Zeiss Toolmakers' Microscope Equipped with "Ocular"

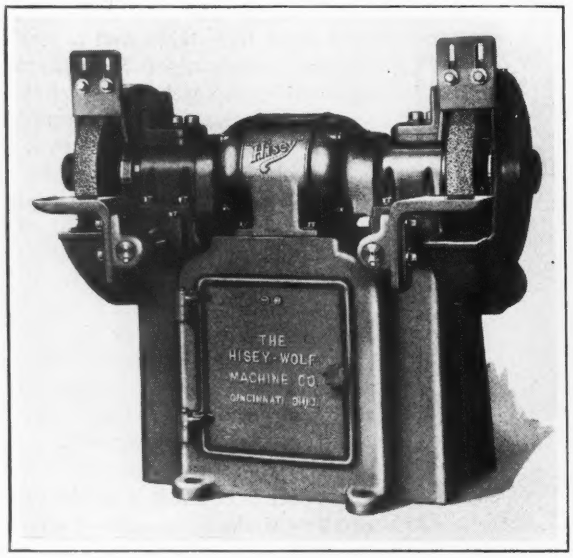
ZEISS IMPROVED TOOLMAKERS' MICROSCOPE

A new model of the toolmakers' microscope made by Carl Zeiss, Jena, Germany, is being placed on the American market by the George Scherr Co., 144 Liberty St., New York City. The new model retains a number of the previous features, such as the patented dial templet; smooth table movement guided by balls; free swiveling table top; and quick-acting micrometer cranks. It is of a heavy construction that deviates from the conventional type.

The table is provided with a longitudinal movement which permits the use of gage-blocks, thereby enabling the range of the instrument to be increased to 2 inches. The cradle for centers and V-blocks is heavy and can be clamped to the table, the centers and V-blocks being guided and clamped in semicircular bearings. The box-type column can be swiveled to bring the microscope tube and illumination jointly into angular positions for the projection of threads in the helix angle. Thread pitch diameters can be measured within limits of 0.0002 inch.

The instrument can be used with both the dial templet and universal "Ocular," as before, but now only the "Ocular" head need be changed. It is made for one-minute readings instead of twenty-minute readings as previously. The microscope tube is furnished with a prism which gives an erect (not inverted) image.

A special projection attachment is available, as illustrated in Fig. 2, for converting the instrument into a contour-measuring projector, thus making pos-



Hisey Floor-stand Grinder Made in 5-, 7 1/2- and 10-horsepower Sizes

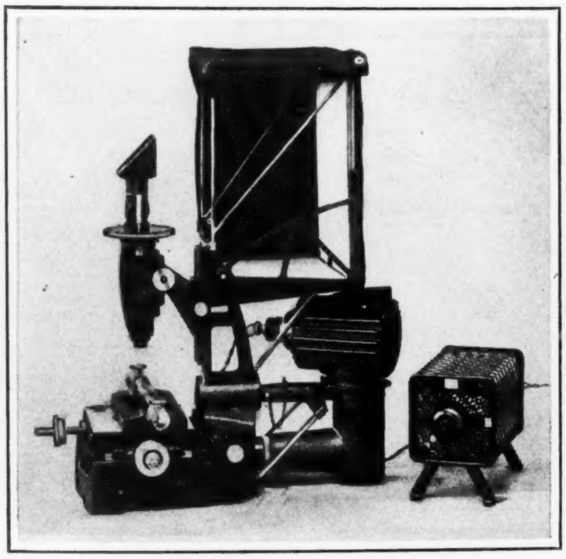


Fig. 2. Toolmakers' Microscope Arranged with Projection Attachment

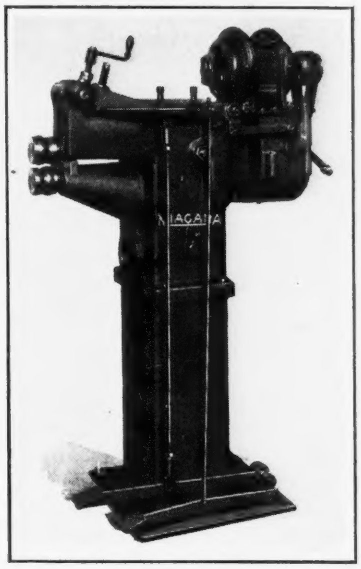
sible observations visible to both eyes on a screen. Images can be compared against drawings thirty times the actual size.

NIAGARA POWER-DRIVEN COMBINATION MACHINE

Turning, wiring, crimping, beading, slitting, and flanging operations on sheet metal can be regularly performed with a No. 180 heavy power-driven combination machine recently placed on the market by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Although this machine is illustrated with a belted motor drive and self-adjusting ball-bearing idler pulley, it can be equipped with a single-pulley drive.

Motion of the rolls is controlled through a clutch which responds instantly to hand or foot control. The clutch can be locked for continuous operation. Vertical adjustment of the top roll is accomplished through a crank-handle and foot-treadle which work independently of each other. Lateral adjustment of the upper shaft is effected by means of two large knurled hand-screws.

All rolls and gages are interchangeable. Provision is made in the frame for receiving a special horn. The machine can then be operated as a circle shear by mounting the circle arm on the horn and using slitting cutters on the roll shafts. A yoke and pivot arm can be attached for holding round blanks to be flanged with special rolls.



Power-driven Machine for Rotary Sheet-metal Operations

EXCELSIOR POLISHING-WHEEL TRUING MACHINE

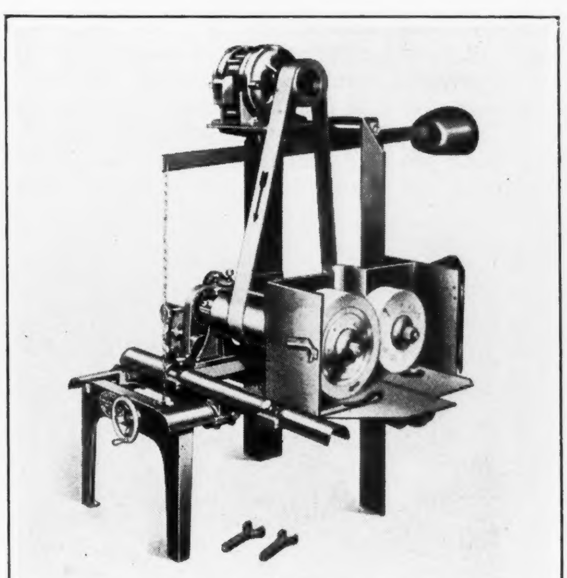
A truing machine intended for use in production shops where grinding, polishing, and buffing wheels are used has recently been added to the products of the Excelsior Tool & Machine Co., East St. Louis, Ill. It is stated that the finest felt, leather, fabric, or buff wheels can be trued to any shape by the use of a straight or master shaped abrasive cutting wheel without burning or injuring the fabric in any way.

The two spindles of the machine are driven in opposite directions by a 7 1/2-horsepower motor. The polishing-wheel spindle has a side oscillating movement of 2 inches in order to retain the straight surface of both the grinding and polishing wheels. This movement is easily disengaged for truing wheels with irregular surfaces, which are made to special requirements. The dust hood of the machine is equipped with hinged doors which are easily opened for changing wheels.

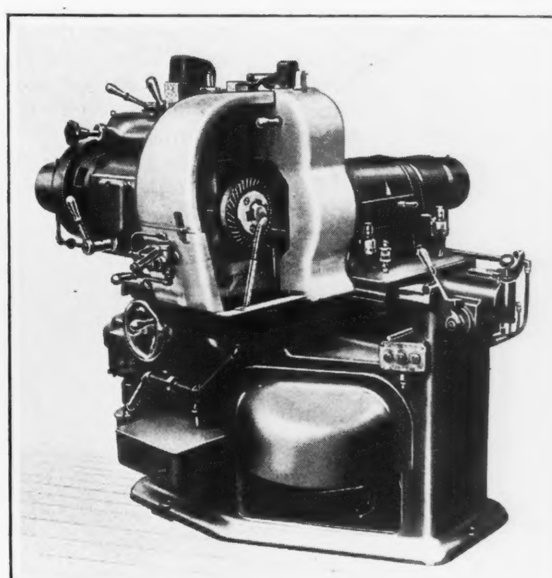
The standard machine will take wheels up to 16 inches in diameter by 6 inches face width. It weighs approximately 2300 pounds.

GLEASON GEAR-LAPPING MACHINE

Spiral-bevel and hypoid gears can be lapped in the machine here illustrated, which has recently been developed by the



Excelsior Truing Machine for Polishing and Buffing Wheels



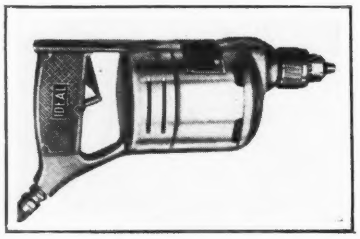
Gleason Lapping Machine for Spiral-bevel and Hypoid Gears

Gleason Works, 1000 University Ave., Rochester, N. Y. This machine can be arranged to suit any size of gear commonly used in the final drive of automobiles, tractors, and trucks. It is intended that the machine be used after hardening so as to smooth out any roughness of the tooth surfaces caused by the heat-treatment, and to correct minor changes in the tooth bearing.

In lapping, the gear and pinion are run together under load, with a mixture of abrasive and oil. The pinion drives the gear, and as they rotate, the gear is automatically given a combined horizontal and vertical movement that results in lapping the entire surface of the teeth.

After the gears have been placed on the spindles, the machine operates automatically. The pinion head is moved into and out of the operating position hydraulically through two hand-levers, the first of which chucks the pinion and moves the head until the pinion is within 3/4 inch of the gear. The second lever operates a special jogging valve which moves the pinion into mesh. Correct meshing is determined by a positive stop. Chucking of the gear is also accomplished hydraulically, and is controlled through a hand-lever.

When the gears are in position and the lapping guard is swung up, the electric circuit is closed so that the machine can be started. If the guards are opened while the machine is running, it will be stopped. An automatic control mechanism times the lapping operation.



Schauer Electric Drill with Sealed Ball Bearings

After the gears have been run in one direction a predetermined length of time, the rotation is reversed for a predetermined length of time. The relative time of lapping the two sides may be adjusted from thirty seconds to thirty-three minutes per side, and the total time may also be varied.

CLARK "STOCK CHASER"

A three-wheeled gasoline-propelled tractor equipped at the rear with a steel platform box measuring 33 1/2 inches wide by 29 1/2 inches long has been placed on the market by the Clark Tructractor Co., Battle Creek, Mich. This "Stock Chaser," as the equipment is called, has a load capacity of 500 pounds. As the turning radius is only 51 inches, the tractor can be advantageously used for such errands as taking tools, jigs, and fixtures from the tool-room to machines; picking up special parts from storage; and carrying mail, shop orders, job tickets, and requisitions from one department to another.

The rear platform can be quickly removed to convert the equipment into a factory tractor capable of hauling 25 tons on trailers through narrow aisles and along crowded platforms.

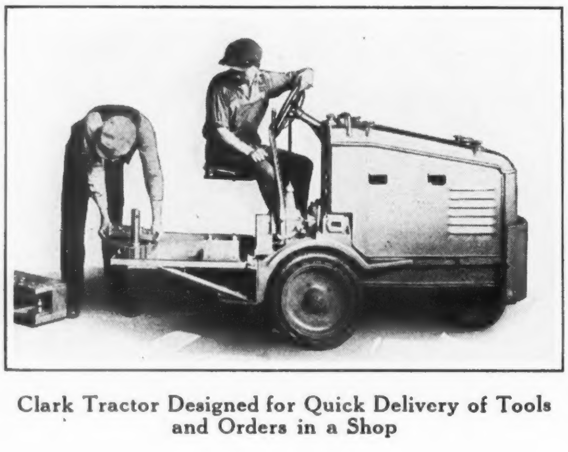
SCHAUER QUARTER-INCH DRILL

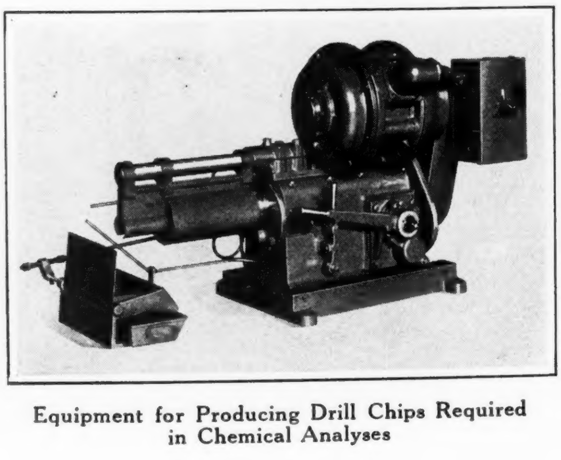
A 1/4-inch standard duty portable drill has been added to the line of "Ideal" electric tools manufactured by the Schauer Machine Co., 905-907 Broadway, Cincinnati, Ohio. This tool measures 10 1/2 inches long over all and weighs only 5 1/2 pounds. It is driven by a special universal motor. The armature and chuck shafts are each mounted in two New Departure sealed-type ball bearings, which construction makes for a shorter drill.

A removable plate on the housing permits ready inspection and adjustment of the commutator and brushes. There is also a removable plate on the handle that permits the switch connections to be inspected conveniently. The grip-type handle contains a trigger switch.

AUTOMATIC DRILL HEAD FOR CHEMICAL TESTS

An automatic drill head was recently developed by the Bradford Machine Tool Co., Cincinnati, Ohio, for use in the chemical laboratory of a large steel corporation. It is employed for obtaining drill chips that are to be used in chemical analyses and that must, therefore, be free from all scale. A 1-inch hole, 1 inch deep, is drilled in the test bars.

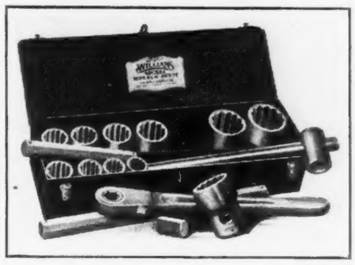

Clark Tractor Designed for Quick Delivery of Tools and Orders in a Shop


Equipment for Producing Drill Chips Required in Chemical Analyses

In operation, the drill advances rapidly, with the chip collector cover closed, and then slows down for the feeding stroke, penetrating 1/2 inch so as to remove all scale and dirt from the test bar. The drill next returns at the rapid traverse rate for a distance of 3/8 inch, and an air jet removes all dirt and chips from the hole and from the cover of the collector box. The drill then advances 3/8 inch at the rapid traverse rate, the air jet is cut off, and the collector box cover opened. Again, the drill automatically slows down for the feed stroke and penetrates to a depth of 1 inch. Finally, it withdraws at the rapid traverse rate to the starting point, and the cover of the collector box closes.

"STEELGRIP" UNIVERSAL GEAR AND WHEEL PULLER

A device for pulling large or small gears, wheels, and pulleys from shafts, even though they may be located a considerable distance from the end of the shaft, is a recent product of Armstrong-Bray & Co., 666 Eagle St., Chicago, Ill. This "Steelgrip" universal gear and wheel puller, as it is called, is designed for easy operation in awkward places. It is regularly equipped with three chains, each 3 feet in length, but longer chains can be furnished. The screw through which power is applied to the chains is made of chrome-nickel steel and has a hardened point. The pulling power of the regular device is approximately 4 tons. A No. 4 heavy-duty puller having a pulling power of over 12 tons has also been made. This puller is intended for unusually large and heavy work.



Williams Detachable Socket Wrenches

SMITH REDUCING GEAR UNITS

Several units have been added to the line of reducing gears manufactured by Winfield H. Smith, Inc., 116 Eaton St., Springville, N. Y. The Nos. 2B and 3B are intended for use with 1/8-horsepower motors. They are equipped with anti-friction bearings throughout. Special ball bearings eliminate the need of stuffing-boxes, and leakage of oil or grease at all shaft extensions is prevented. The No. 2B unit can be furnished in ratios of 48 to 1 and 30 to 1, while the No. 3B can be supplied in ratios of 20 to 1, 10 to 1, and 5 to 1.

A No. 2DB unit can be furnished in ratios of 400 to 1, 200 to 1, and 100 to 1. This unit has a double worm-gear drive capable of transmitting a torque load of 150 inch-pounds.

WILLIAMS DETACHABLE SOCKET WRENCHES

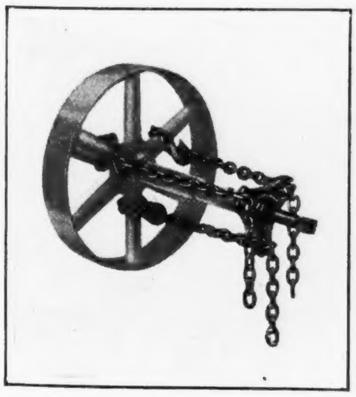
A new line of detachable socket wrenches is being introduced on the market by J. H. Williams & Co., Buffalo, N. Y. This line includes three distinct socket patterns with a full assortment of handles and parts for each, to cover practically all industrial needs.

There is a standard pattern with a 1/2-inch square drive that includes sockets with hexagonal, double hexagonal, and square openings up to 1 inch. This pattern is intended for ordinary needs. A heavy-duty pattern has a 3/4-inch square drive and double-hexagonal socket openings from 7/8 to 1 1/8 inches. This pattern is intended for harder service than the ordinary run of work. The third or extra heavy-duty pattern has a 1-inch hexagonal drive and double hexagonal socket openings from 1 1/16 to 2 3/8 inches. This pattern is designed for the heaviest service.

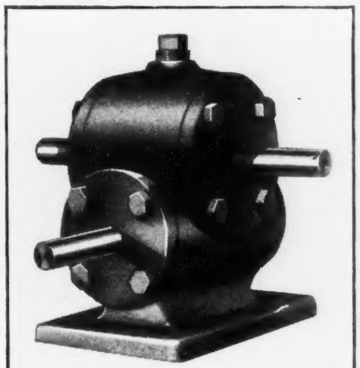
These socket wrenches are available in selections of popular sizes of sockets, in combination with the necessary handles and parts. Assembled sets are furnished in a convenient steel box provided with trays or compartments. All sockets, handles, and accessories are chromium-plated over nickel.

CUTLER-HAMMER CONTROLLERS AND STARTERS

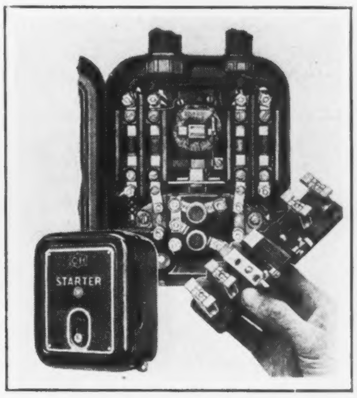
The entire line of Type AAA automatic starters manufactured by Cutler-Hammer, Inc., 1203



"Steelgrip" Puller for Wheels, Gears, and Pulleys



Reducing Gear Added to the Line of Winfield H. Smith, Inc.



Cutler-Hammer Across-the-Line Starter with New Contactor

St. Paul Ave., Milwaukee, Wis., for small alternating-current motors, has been redesigned to incorporate a newly developed "Twin Break" magnetic contactor. The contacts of this new contactor are of heavy coin silver, which retains its current-carrying capacity even if oxidized and always makes a good contact with little temperature rise. The "Twin Break" principle reduces the arc voltage by half, and "Thermoplax" arc pockets reduce the air content around the contacts, thus preventing the formation of a destructive arc. A magnetic latch obviates accidental closure of the contacts if the starter is bumped or tilted.

These new contactors are made in three- and four-pole types. The maximum ratings for two- or three-phase current are: 3 horsepower, 110 volts; 5 horsepower, 220 volts; and 7 1/2 horsepower, 440 or 550 volts.

This company has also developed a new automatic controller for two-speed consequent pole type squirrel-cage motors. This controller functions to start the motor and to change its speed by reconnecting the motor windings. It provides thermal overload protection at both motor speeds and high voltage protection. A separate push-button master switch with "Stop," "Low," and "High" buttons gives a three-wire remote control. This controller is furnished for constant-torque, variable-torque or constant horsepower motors.

ALLEN-BRADLEY ELECTRICAL DEVICES

A hand-operated alternating-current starting switch with overload breakers, which has just been placed on the market by the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis., is shown in Fig. 1. This starter is intended for use with motors up to 3 horsepower, 110 volts; 5 horsepower, 220 volts; and 7 1/2 horsepower, 440-550 volts. Overload breakers operating on the soldered ratchet principle eliminate the maintenance of thermal plugs and fuses. They interrupt any overload and are reset without opening the switch cover.

Fig. 1. Allen-Bradley Starter with Overload Breakers

Fig. 2 shows an automatic float switch which has also been developed by the same concern to provide an automatic motor control for pumps and similar equipment. This float switch is of the contactor type operated by an arm working against a cam leverage to insure a quick make-and-break of the contactor. Different sizes of this switch can be furnished for use with alternating-current motors from 1 1/2 to 5 horsepower and for direct-current motors from 1 to 2 horsepower.

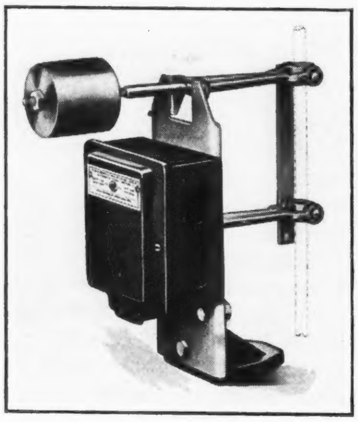
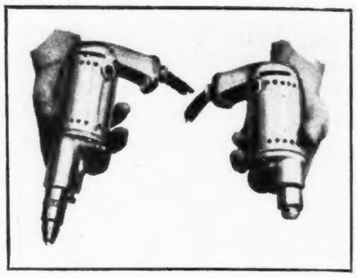


Fig. 2. Allen-Bradley Automatic Float Switch

BLACK & DECKER DRILL AND SCREWDRIVER

A 3/16-inch drill and a small screwdriver have recently been added to the line of portable electric tools made by the Black & Decker Mfg. Co., Towson, Md. These tools, which are known as the "Universal Twins," have been designed for use in close quarters, being short and small in diameter.



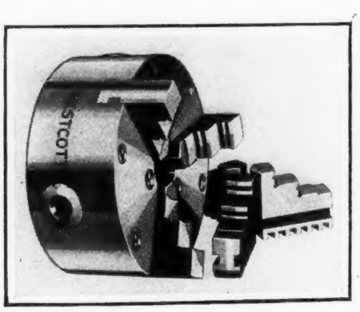
Black & Decker "Universal Twins"

The screwdriver is equipped with an adjustable friction clutch which releases immediately after the screw has been driven flush, and thus avoids marring the screw head or the surrounding surface. The clutch can be set quickly to any desired tension and can be adjusted to suit different types and sizes of small screws, as well as to compensate for the different conditions encountered in driving screws into wood and metal. There is also a positive clutch which allows the spindle to remain idle until the screw slot has been found.

Both the drill and screwdriver are provided with a universal motor.

WESTCOTT SCROLL LATHE CHUCKS

A line of bevel-gear scroll universal lathe chucks of the design illustrated is being introduced on the market by the Westcott Chuck Co., 116 E. Walnut St., Oneida, N. Y. These chucks are to be made regularly in twelve sizes ranging from 3 to 24 inches, and sizes above 24 inches will be made to order. At the present time, only the 4-inch size is available.



Westcott Bevel-gear Scroll Lathe Chuck

All chucks will be made with one-piece bodies, and steel forgings will be used exclusively for the smaller 3-, 4-, 5-, and 6-inch sizes. Larger sizes will be provided with semi-steel or electric steel bodies. The chucks will be furnished with two sets of jaws, with one set for either outside or inside chucking, or with two-piece reversible jaws. Two sets of jaws are shown with the chuck illustrated.

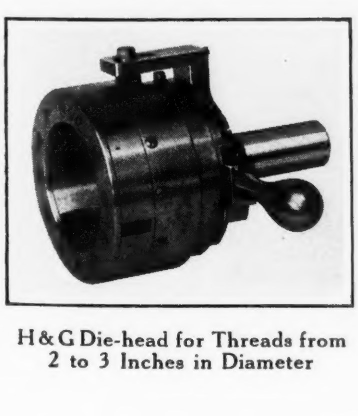
H & G DIE-HEAD FOR TURRET LATHES

A light-duty die-head known as No. 10, Style D, intended for use in turret lathes, has been placed on the market by the Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn. This die-head has been designed especially for cutting threads of large diameter and relatively small pitch. Threads from 2 to 3 inches in diameter and of not less than 10 threads per inch can be cut to lengths of not over 2 1/4 inches.

Six chasers are included in each set, and these chasers are operated on the H & G principle. Cams that are solidly supported by the body engage diagonal slots in the chasers, so that the chasers are not only supported directly over the cut, but are also opened in a positive manner.

The die-head has a detachable shank which can be supplied in various diameters. The thread length adjustment is carried on an arm which extends from the shank. Adjustments for pitch diameter are made by a micrometer screw on the front face.

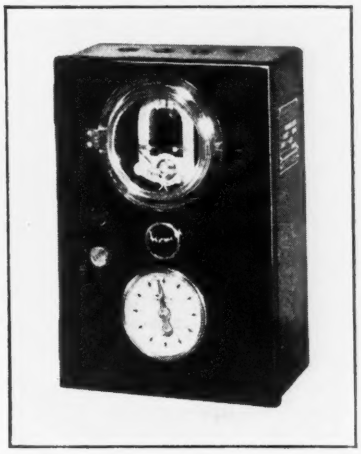
This No. 10 die-head weighs only 21 pounds, has an outside diameter of 5 3/4 inches, and an over-all length, exclusive of the shank, of 4 7/16 inches. It has ample float, which, together with the lightness, makes it especially suitable for use on the softer metals in cutting short threads of fine pitch.



H & G Die-head for Threads from 2 to 3 Inches in Diameter

"HEVI DUTY" EXCESS TEMPERATURE CUT-OUT

An automatic device designed for application to any type of furnace for guarding the work or furnace from damage due to overheating has been developed by the Hevi Duty Electric Co., Milwaukee, Wis. This instrument responds to a thermo-couple located in the furnace chamber which actuates a thermal cut-out to control a relay that is part of the furnace control system.

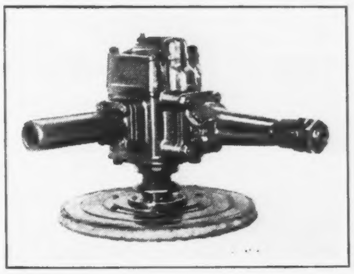


Instrument which Protects Furnaces from Overheating

Adjustable controls are provided so that the instrument can be set for any desired temperature. It can be calibrated for any thermo-couple and used for protection purposes at temperatures up to 3000 degrees F. When the relay is actuated, the heating source is shut off and a light goes on or an alarm bell rings to attract the attention of the operator.

THOR ROTARY PNEUMATIC SANDER

A governor that acts in two ways is one of the principal features of a Thor No. 260S rotary pneumatic sander being introduced on the market by the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill. When the sander is at peak load, the governor automatically opens the throttle to admit as much air as is necessary to do the job efficiently. When the motor runs idle, the governor automatically decreases the air consumption, thus saving wear and tear on the moving parts. This feature is claimed to result in longer life of the sander, lower maintenance cost, and less air consumption.

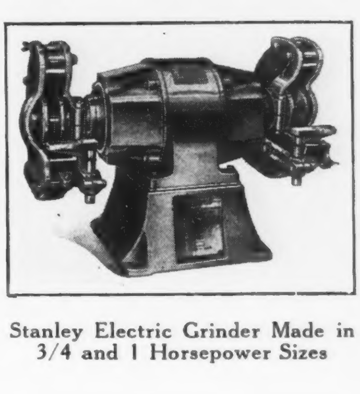


Thor Pneumatic Sander with Double-acting Governor

The sander is of the center spindle type and is equipped with two handles. One of its main applications is in automobile body plants for dressing welded seams and removing high spots. The sander operates at a speed of 4500 revolutions per minute, is 8 inches long over-all, and weighs 10 pounds without the wheel or disk.

STANLEY ELECTRIC GRINDERS

Four 10-inch grinders have been added to the line of electric tools manufactured by the Stanley Electric Tool Co., New



Stanley Electric Grinder Made in 3/4 and 1 Horsepower Sizes

Britain, Conn. They are made in two sizes, of 3/4 and 1 horsepower rating, and in both bench and pedestal styles.

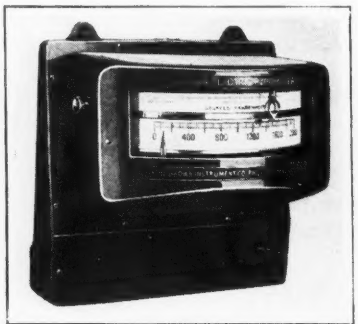
The No. 610 bench grinder is recommended for continuous service; it operates at a speed of 1725 revolutions per minute on 30- and 60-cycle alternating current, at 1425 revolutions per minute on 25- and 50-cycle alternating current, and at 2100 revolutions per minute on direct current. The distance between the grinding wheels is 14 1/2 inches, and the weight is 153 pounds.

The No. 1610 pedestal grinder is of the same construction as the No. 610 grinder, except that it is mounted on a cast-iron floor pedestal equipped with a shelf and a water-pot.

The No. 810 bench grinder is a heavy-duty tool which is also intended for continuous service. It operates at the same speeds as the two grinders referred to in the foregoing, measures 20 inches between the wheels, is 26 inches long over all, and weighs 183 pounds. The No. 1810 pedestal grinder consists of the No. 810 bench grinder mounted on a floor pedestal.

BLACK & DECKER BUFFING MACHINE

Spindle speeds from 2000 to 3000 revolutions per minute are obtainable on the buffing machine here illustrated, which is being introduced to the trade by the Black & Decker Mfg. Co., Towson, Md. Different speeds can be used for the two spindles at the same time. Speeds may be selected through quick-change pulleys applied to the motor shaft in the base.



Brown Indicating Pyrometer Controller

The buffing heads are each driven by two "cog" belts, and they can be stopped at will by means of a clutch, there being a separate clutch for each spindle. The spindles are equipped with automatic brakes so that the buffing head is stopped immediately when the clutch is disengaged.

The motor is of a heavy-duty ball-bearing type, and is mounted on a removable steel plate that is lowered or raised by a handwheel to maintain the proper belt tension.

BROWN INDICATING PYROMETER CONTROLLER

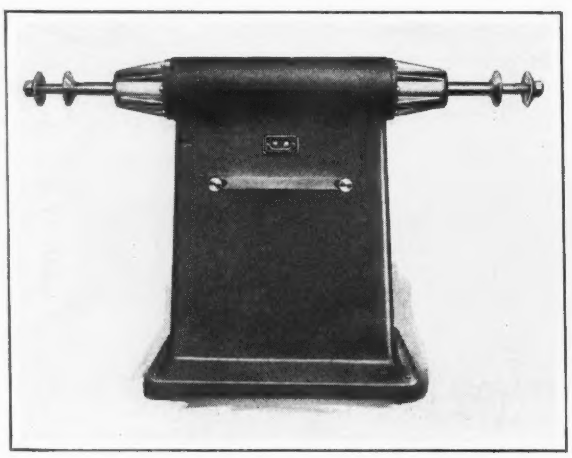
An indicating pyrometer controller that can be supplied as an automatic control pyrometer, resistance thermometer, tachometer, or CO_2 meter, is shown in the accompanying illustration. This instrument is a recent development of the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Readings are observed directly on a 6-inch scale, and there is an index on the scale for setting to the exact control point. This control point is instantly adjustable.

All wiring terminals and the motor are enclosed so that there is no danger in using the instrument in the presence of explosives or inflammable gases. Mercury switches up to 30 amperes in capacity are provided to eliminate the necessity of relay equipment. Make and break of the switches occur in a sealed glass tube; consequently, sparks cannot cause explosions. The instrument is suitable for "on and off" or "three position" control through switches, valves, dampers, etc.

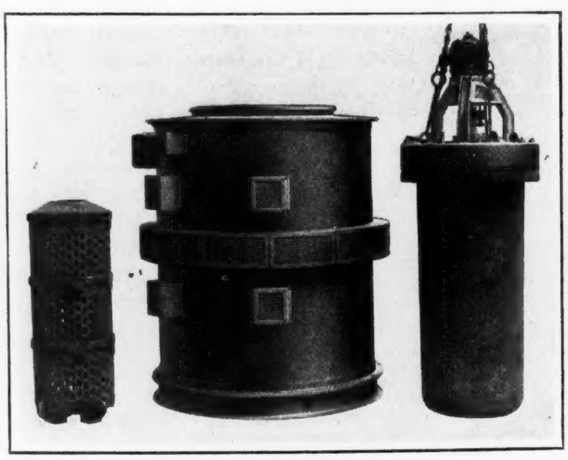
A patented safety device is available which will open the furnace circuit if the thermocouple or wiring fails, thus preventing burning out the furnace. An automatic internal compensation eliminates cold-junction errors when the instrument is supplied as a pyrometer.

VERTICAL PRESSURE CARBURIZING FURNACE

An electric pressure-type carburizing furnace of vertical design, as illustrated, has recently been brought out by the Hevi



Black & Decker Buffer with Two Spindles which Can be Run at Different Speeds



Vertical Pressure Carburizing Furnace Made by the Hevi Duty Electric Co.

Duty Electric Co., Milwaukee, Wis. This furnace is a standard crucible type, having elements mounted in the side walls which radiate and reflect the heat directly to the retort. A three-section alloy basket in which the charge is placed fits into a nickel-chromium retort which is bolted to the cover and sealed air-tight. The cover has a motor-driven fan for circularizing the carburizing gases evenly throughout the entire charge.

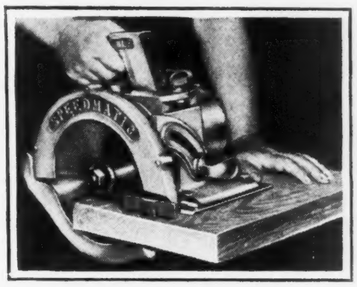
The carburizing gas is premixed in an automatic device with a predetermined amount of air, and is compressed to a pressure of 10 pounds per square inch. It is then delivered through the furnace cover to the charge. The amount of carbon in the case is controlled accurately by the air ratio.

It is stated that when the furnace is operated continuously, four heats can be run in twenty-four hours on ordinary normalized carburizing steels with a penetration of approximately 1/16 inch at a retort temperature of 1675 degrees F. "Carbonal," a Hevi Duty patented carburizing liquid is also employed successfully in this furnace. The furnace is manufactured and sold under a license agreement with the American Gas Furnace Co.

TWO-SPEED GEAR UNIT

A two-speed gear unit with a fully enclosed, dustproof split housing is being introduced to the trade by Gears & Forgings, Inc., Cleveland, Ohio. The two speeds are controlled outside of the unit by means of a conventional ball-and-socket shift lever which operates a clutch. This clutch is of the ten-jaw type, facilitating prompt engagement at either speed or any load.

The principal bearings of the unit are of the anti-friction type. Through a unique arrangement of the gears, the oil level is maintained below the input and output shafts, thus preventing oil leakage. All gears and bearings are lubricated by the splash system.



"Speedmatic" Hand Saw with Spiral-gear Drive

"SPEEDMATIC" HAND POWER SAW

A new "Speedmatic" power-driven circular hand saw designated the Type K-9 is being placed on the market by the Porter-Cable-Hutchinson Corporation (formerly the Porter-Cable Machine Co. and the Hutchinson Mfg. Co.), Salina and Wolf Sts., Syracuse, N. Y. While this saw is similar in general appearance to the Type K-8, it is mechanically different in that it is a gear-driven type. The motor is of 1 1/4-horsepower rating and drives the arbor through spiral gears.

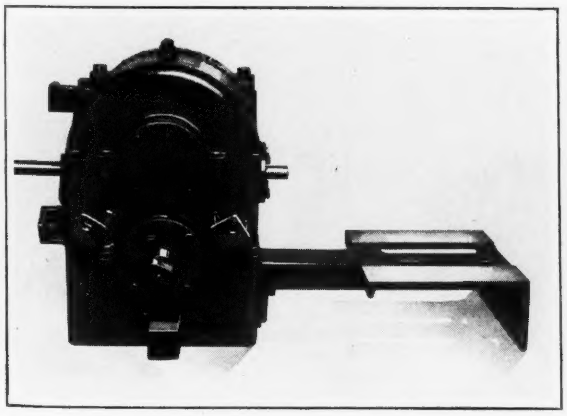
The reduction ratio is such as to drive the 9-inch saw blade at a free speed of 5000 revolutions per minute and at an average load speed of 4000 revolutions per minute. At this high speed it is said to be possible to rip a 3-inch plank 12 feet long in one minute. The saw will cut to a maximum depth of 3 1/8 inches. The saw speed is such that thin emery wheels can be used for cutting soft metals.

This saw has an over-all length of 12 1/2 inches and weighs about 23 pounds.

KEARNEY & TRECKER "POSITIVE-LOCK" FACE MILLING CUTTERS

A line of "Positive-Lock" face milling cutters of the inserted blade type has been developed by the Kearney & Trecker Corporation, Milwaukee, Wis., for use in production and general-purpose milling. These cutters are intended primarily for taking medium roughing and finishing cuts. The blades are so spaced that the cutters can be used for milling surfaces made up of thin, narrow sections. In the illustration Fig. 1 is shown a group of cutters ranging from 5 to 16 inches in diameter.

Two styles are made, one of which is equipped with high-



Gear Unit Developed by Gears & Forgings, Inc., which Operates at Two Speeds

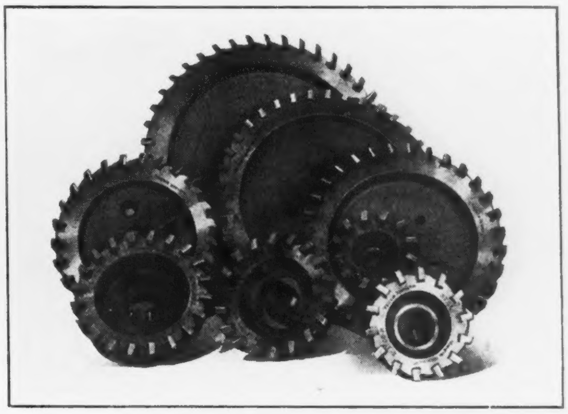


Fig. 1. "Positive-Lock" Face Milling Cutters from 5 to 16 Inches in Diameter

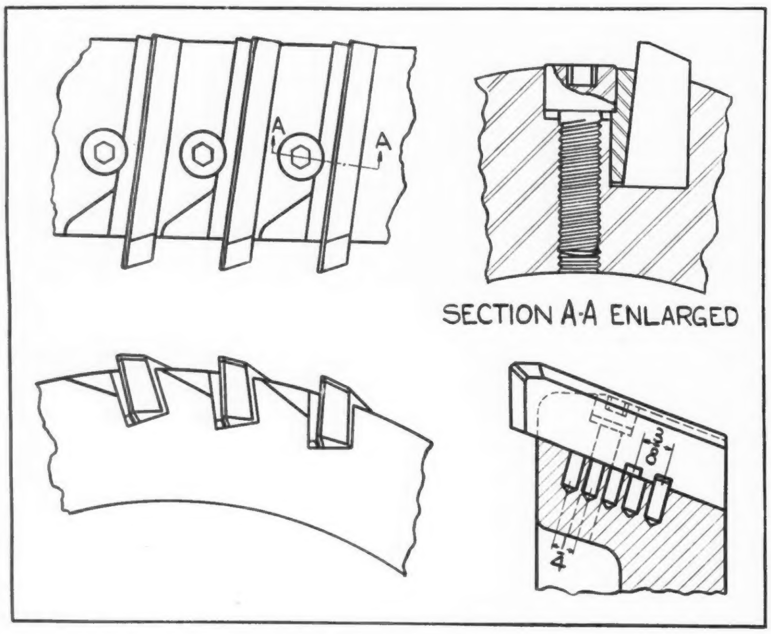


Fig. 2. Method of Holding the Blades of "Positive-Lock" Face Milling Cutters

speed steel blades and the other with Stellite blades. The only difference in the two styles is in the angular mounting of the blades. The angles have been selected with a view to obtaining the highest cutting efficiency and the longest life between grinds from each of the cutting materials. The cutter blades can also be tipped with cemented tungsten carbide. The cutter bodies are chrome-nickel steel forgings.

As shown in Fig. 2, each blade is positively locked by means of a hardened and ground tapered wedge. The front side of the blade is ground to a taper corresponding with the contacting face of the wedge. When the screw is in place, there is no danger of the blade lifting out of place, even though the wedge should loosen slightly.

End slippage of any blade is guarded against by a set of small pins, one of which is assembled in each slot of the cutter body to fit into one of the grooves on the bottom of the blades. This construction offers a positive end support for each blade and prevents it from slipping under the pressure of a heavy cut.

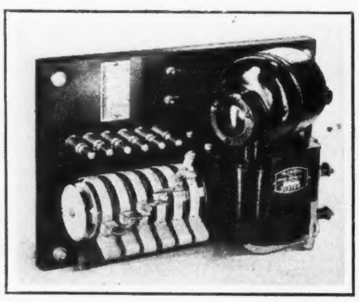
The cutter bodies are cone-shaped so that the blades are positioned at an angle to the body axis. This construction facilitates the maintenance of a uniform outside diameter as the blades become worn. Uniformity is maintained by adjusting the blades outward and then grinding the bottom and peripheral faces to suit.

The cutters are made in fourteen sizes ranging from 5 to 24 inches in diameter. The 5-, 6-, and 7-inch cutters are designed for use with Style C shell end-mill arbors; the 8-inch cutter is arranged for bolting on the spindle and centering with a plug; and the larger sizes are centered over the spindle nose.

MONITOR WORK-CYCLE TIMER

The latest control device to be added to the products of the Monitor Controller Co., Gay, Lombard, and Frederick Sts., Baltimore, Md., is a work-cycle timer which is designed to meet the timing requirements of any electrically controlled work cycle. This device will start, stop, accelerate, decelerate, reverse, heat, cool, open, close, raise, lower, etc., in sequence and at definite time intervals that may be accurately adjusted. It can be reset instantly to the starting point at any time during or after the completion of the cycle.

The current-carrying switches in a given unit are all electrically connected on a pivoted side. Each individual switch consists of a rotatable disk carrying an adjustable contact point and a post fixed on the panel and connected directly to the circuit to be controlled. There are as many of these little switches as there are circuits in the sequence.



Monitor Device for Controlling Work Cycles Electrically

STANLEY PORTABLE ELECTRIC DRILLS

Two 3/16-inch portable electric drills have recently been brought out by the Stanley Electric Tool Co., New Britain, Conn., primarily for service in the production of automobiles, assembly of airplanes, construction of furniture, etc. They weigh only 3 1/4 pounds, and are 8 1/4 inches long.

The difference between the two drills lies in the housing. The No. 361 is provided with an aluminum-alloy housing that is not liable to damage if dropped, while the housing of the No. 361B is a special composition that acts as an insulation against heat, thus permitting the tool to be handled comfortably when drill-

Stanley Electric Drill Weighing Only 3 1/4 Pounds

ing continuously over a long period of time.

The armature shaft of both drills runs in seal-type ball bearings, and side play of the chuck spindle is eliminated through the use of radial ball bearings at each end. Both drills are driven by a universal motor which provides a no-load chuck speed of 3000 revolutions per minute and a full-load speed of 2000 revolutions per minute.

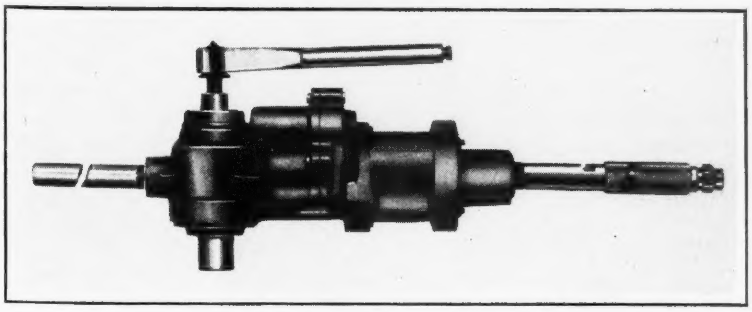
NATIONAL-CLEVELAND COUNTERBORES AND SPOT-FACERS

Interchangeable counterbores and spot-facers with a double key drive are being placed on the market by the National Tool Co., Madison Ave. at W. 112th St., Cleveland, Ohio, in over forty sizes ranging from 3/4 to 5 inches in cutter diameter. The tools are provided with one key on the cutter and another on the holder. This construction has been adopted with a view to obtaining maximum driving strength and permanent alignment of the counterbore or spot-facer with the holder and pilot, regardless of whether the counterbore or spot-facer sweeps around a complete circle or a partial circle only. These tools may be advantageously employed for angular counterboring. The cutters are made of high-speed steel, and the pilots and holders of alloy steel. They are all hardened and ground.

HERCULES HEAVY-DUTY DRILL AND REAMER

A heavy-duty drill and reamer has been added to the line of Hercules tools made by the Buckeye Portable Tool Co., Dayton, Ohio. This tool may be obtained for operation at 150 or 200 revolutions per minute. It is 9 inches long over all, weighs 37 pounds, and has a feed of 2 1/4 inches. It is equipped with a twist throttle and a No. 4 Morse taper socket.

This tool is designed to meet the requirements of structural-steel work, shipyards, railroad shops, and builders of heavy equipment such as engines and machine tools.



Hercules Heavy-duty Pneumatic Drill and Reamer

PALMGREN VISE AND BORING TOOLS

A universal vise for production or tool-room work and an offset boring tool have recently been added to the products of the Chicago Tool & Engineering Co., 8389 S. Chicago Ave., Chicago, Ill. The universal vise, for use on milling, drilling, grinding, and planing machines, has the base and body hinged together, as shown in Fig. 1. The base can be bolted to the table of the machine and the body used in a horizontal position like an ordinary machine vise or it can be tilted to any desired angle within the range of a scale which is graduated in degrees.

The T-wrench used for locking the vise in position is also employed for operating the worm that provides the angular adjustment. The hardened and ground jaws are 6 inches wide, 1 7/8 inches deep, and open to a width of 4 inches. The vise weighs 80 pounds, and can be furnished with extra jaws having horizontal or vertical grooves. A swivel base can also be supplied.

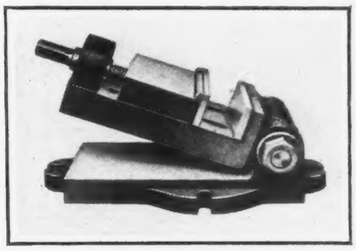


Fig. 1. Palmgren Adjustable Machine Vise

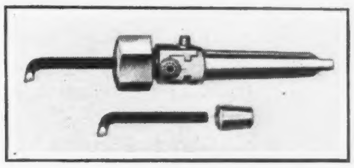


Fig. 2. Palmgren Offset Boring Tool

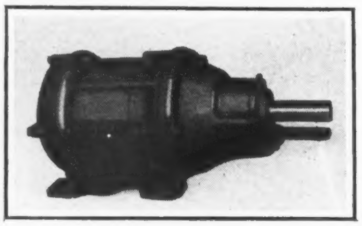
The offset boring tool, shown in Fig. 2, is designed with a small, compact body for use where space is limited. Accurate micrometer adjustment, a wide range of travel, and easy removal of the tool are features of this product. It can be used on turret lathes, milling machines, or drill presses. All parts of the tool are hardened and are designed to maintain accuracy under severe working conditions. This tool is made in two sizes, the No. 1 size having an offset of 3/4 inch and a collet capacity of 1/2 inch diameter, while the No. 2 size has an offset of 1 1/4 inches and a collet capacity of 5/8 inch diameter.

BUNTING LEAD HAMMER

A lead hammer that is made in a 2 1/2-pound size is being placed on the market by the Bunting Brass & Bronze Co., Toledo, Ohio. This hammer is assembled to a 10-inch steel handle. It supplements the line of "copper-bronze" hammers described in the September number of MACHINERY, page 75.

MOTORIZED SPEED REDUCERS

Motorized speed reducers, in capacities of 1/2 to 20 horsepower, for providing a straight-line drive with final driving speeds as low as 50 to 550 rev-



Motorized Speed Reducer

olutions per minute, have recently been added to the line of motorized products manufactured by the Production Equipment Co., 5219 Windsor Ave., Cleveland, Ohio. A standard heavy-duty electric motor of this company's manufacture with an integral planetary gear reduction unit mounted in an oil-tight housing form the complete motorized speed reducer, as shown in the illustration. This equipment can be supplied in single-speed, multi-speed, enclosed, and high-torque designs for either horizontal or vertical mounting.

* * *

EXPORTS OF INDUSTRIAL MACHINERY

In spite of the general depression in the machinery industries, the exports of industrial machinery for the first eight months of 1930, according to statistics just published by the Industrial Machinery Division of the Department of Commerce, were only 2 per cent less than the record exports for the same period in 1929. The total industrial machinery exports for the first eight months of the present year reached a value of $164,531,000.

The exports of metal-working machinery held up remarkably well and show substantial gains for the first eight months over the corresponding period last year, the total value for this period in 1930 being $31,708,000 as compared with $27,464,000 in 1929. The export shipments of engine and turret lathes were 35 per cent greater, and of milling machines, 48 per cent greater than last year. The exports of drilling machinery were 65 per cent greater than for the corresponding period in 1929.

NEW BOOK ON DIE DESIGN AND DIEMAKING

DIE DESIGN AND DIEMAKING PRACTICE. 921 pages, 6 by 9 inches; 590 illustrations. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Price, $6.

This new book on dies is believed to be the largest and most complete treatise in existence on the design, construction, and practical application of all classes of sheet-metal-working dies. Most of the dies shown are unusual, either in design or because of the exceptional nature of the work performed, and the important features of every die described are illustrated by one or more line engravings or drawings. All this material has been submitted to MACHINERY'S publishers by die designers and diemakers throughout the United States, so that men of experience in the die industry have created for themselves this general work of reference.

All the subject matter is arranged to facilitate finding both general types of dies and specific modifications of a given type. Not only are dies of the same general classes grouped together in chapters, but in some instances these general types are subdivided. For example, there is a chapter on blanking dies, with a special chapter on blanking dies for rotor and stator laminations, and still another on blanking dies of the sub-press class. The arrangement of the drawing dies is an unusual feature, as they have been placed in chapters according to the general shapes of the parts produced. For example, dies for shallow cylindrical shells are in one chapter, and dies for comparatively deep shells in another. Similarly, dies for shallow and deep shells that are mainly conical in form have been segregated, as well as other types permitting this classification.

This arrangement often makes it possible to find a certain design of die without using the index, and designs for similar operations can be compared readily. Many of the dies illustrated previously in "Diemaking and Die Design" have been included in this new treatise to insure completeness and present certain designs, rules, and general information of value.

Since the exact procedure in making dies varies more or less for each design, and as standard and well-known machining methods are often employed, the sections of this book on diemaking practice give special information capable of general application. One chapter explains different methods of figuring blank diameters; another deals with the laying out of dies, the fitting and locating of punches, rotary filing, punch and die clearance, shear, temporary die construction, points on making compound dies, kinds of die steels used, heat-treatment of dies, and similar information.

In the chapter on punch and die details, which covers different methods of holding punches, ejecting parts both mechanically and pneumatically, etc., there is considerable information about die construction, and this is true of many other chapters, like the ones on "Stops for Positioning Stock" and "Sectional Punch and Die Construction"; in fact, practical diemaking hints are given throughout the book in connection with descriptions of different designs.

* * *

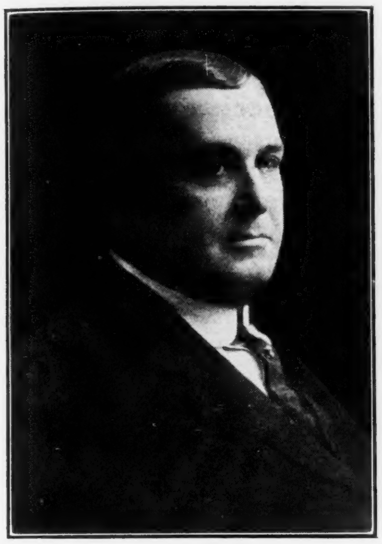
HOW TO DEVELOP EXECUTIVE ABILITY

1. Plan the details of your job before beginning work.
2. Budget your time; set a plan for the day's work.
3. Make it a point to get the facts, not to guess; to know, not to take things for granted.
4. Make definite decisions about small things as well as large.
5. Have a reason for doing a job in the way you do it, basing your conclusions on known facts, as far as possible.
6. Get into the habit of asking yourself "why" in regard to every job or action.
7. Develop your memory so that future decisions will depend on past experience.

OBITUARIES

HARDING ALLEN

Harding Allen, head of the Charles G. Allen Co., Barre, Mass., died October 11 at his home in Barre. Mr. Allen was born in 1867 and was educated in the local schools of Barre, later attending a business college in Poughkeepsie, N. Y. He early became associated with his father, Charles Gilbert Allen, in the latter's manufacturing enterprise, and



Harding Allen

in 1896, after his father's death, he purchased the business from his father's estate, gradually developing it into a machine tool building plant. In 1908, Mr. Allen obtained his first patents on a ball-bearing sensitive drilling machine, which has since been the main manufactured product of the company.

Mr. Allen was closely identified with the business and social life of his community, and was prominent in many business and fraternal organizations. He was president of the Second National Bank of Barre, and a director of the Worcester Bank & Trust Co. and the Worcester County National Bank, as well as a former trustee of the Barre Savings Bank.

LEANDER S. HEALD

Leander S. Heald died October 12 at his home in Worcester, Mass., after a long illness, at the age of ninety-four years. Mr. Heald was born in Barre, Mass., and was the son of Stephen Heald, who founded a machine shop in Barre in 1826. He joined his father in this enterprise, and in 1890, after his father's death, he carried on the business with his son, James N. Heald, under the firm name of L. S. Heald & Son. In 1903, Leander Heald retired from business, and at that time sold his interest to his son, who moved the plant to Worcester, Mass., organizing the present Heald Machine Co. of which he is now president and general manager.

PERSONALS

Edward Blake is now affiliated with the Tremont Mfg. Co., 55 Amory Ave., Roxbury, Boston, Mass., in the capacity of general manager.

W. L. Batt, president of the SKF Industries, Inc., New York City, has been elected a member of the council of the American Society of Mechanical Engineers to serve for three years.

R. A. Schoenfeld has been appointed sales engineer, with headquarters in Chicago, of the Hevi Duty Electric Co., Milwaukee, Wis. Mr. Schoenfeld has been sales manager of the Claud S. Gordon Co., Chicago, Ill., for the last seven years. He will devote his time to solving heat-treating problems and selling electric heat-treating furnaces.

L. B. Mead has been appointed assistant industrial manager of the northwest district of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., with headquarters at Chicago. William J. Morgan has been made Indianapolis manager for the firm.

Ray H. Morris, for the last three years district manager of the Rochester office of Brace-Mueller-Huntley, Inc., has joined the sales staff of the Davenport Machine Tool Co., Inc., Rochester, N. Y. Mr. Morris' territory will include New York state, southern New England, and northern New Jersey.

Warren Maxwell has been appointed superintendent of the Dodge Works of the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., to replace the late F. J. Oakes. Mr. Maxwell entered the sales department of the company in 1922, and in 1929, he was made assistant superintendent, from which position he has just been promoted.

B. L. Donahue has been appointed manager of the Buffalo district office of Cutler-Hammer, Inc., Milwaukee, Wis., succeeding B. A. Hansen. Mr. Donahue has been connected with the Pittsburgh branch office of the company for the last eight years.

B. L. Donahue

Frederick M. Kreiner was elected a vice-president of Manning, Maxwell & Moore, Inc., 100 E. 42nd St., New York City, at a recent meeting of the executive committee. Mr. Kreiner will continue to fill his duties as treasurer of the company, which position he has held since 1920. He has been connected with the company since 1903.

Clifford S. Stilwell has been appointed sales manager of the Warner & Swasey Co., Cleveland, Ohio. Mr. Stilwell has been associated with the company

Clifford S. Stilwell

since his graduation from Denison University in 1912, when he became a special apprentice in the works at Cleveland. Following two years as representative in the Chicago and Detroit offices, he was made district manager in Detroit in 1915. He assumed his new duties October 1, with headquarters in Cleveland.

F. Maurice, commercial manager of the Société Genevoise d'Instruments de Physique, who arrived in the United States previous to the Metal Exposition in Chicago in the latter part of September, and who has since then visited a number of the more important industrial centers in the United States, and inspected several of the leading plants in the machine tool industry, returned to Europe late in October.

Oscar Lorange, formerly a manufacturers' representative handling Ex-Cell-O Aircraft & Tool Corporation's products in connection with several other leading tool lines, has been placed on the New York sales staff of the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., and is covering the New England territory. William H. Scheer, formerly with the Clark Equipment Co. of St. Louis, Mo., is now connected with the Dayton office of the company, and is assigned to the Cincinnati territory.

C. H. Ribble, for six years in charge of the New York office of the Industrial Controller Co., has joined the New York sales staff of the Allen-Bradley Co. at

Uniform H

Because —

Careful Selection of Materials
Correct Design
Accurate Machining
Proper Heat Treating
Years of Experience in Manufacturing

give Brown & Sharpe Cutters the ability to take more cuts between sharpenings.

The Cost of

Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

What Is the Real Cost of Your Cutters?

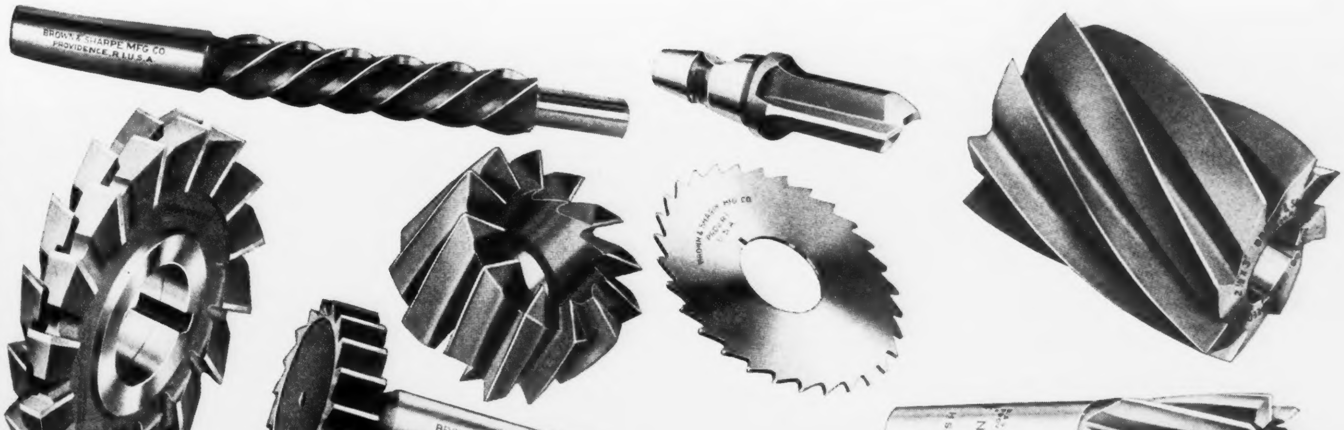
B·S

Brown &

High Production is Maintained with Brown & Sharpe Cutters

Brown & Sharpe Cutters will maintain a high level of production on your work — at lowest *real* cutter cost. Our line of stock cutters includes those necessary for every type of milling requirement, and we are equipped to supply promptly cutters for special work.

Ask for your copy of Small Tool Catalog No. 31 listing a complete line of cutters. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.



Sharpe Cutters

Lower Production Costs

50 Church St., New York City. GEORGE BREUER, formerly connected with the printing press control department of the General Electric Co., Schenectady, N. Y., has also joined the sales force of the Allen-Bradley Co., with headquarters in New York. H. J. STAIB, formerly connected with the Century Electric Co., St. Louis, Mo., has been added to the sales staff of the Cincinnati office of the Allen-Bradley Co.

NEWS OF THE INDUSTRY

ROLLER-SMITH CO., 233 Broadway, New York City, announces the appointment of J. K. Webb as district sales agent for the state of Texas, with headquarters at 601 Allen Building, Dallas, Texas.

ST. JOHN X-RAY SERVICE CORPORATION, 505 Fifth Ave., New York City, has made arrangements with the Westinghouse X-Ray Co., Inc., to sell Westinghouse equipment in the industrial fields.

WORTHINGTON PUMP & MACHINERY CORPORATION, 2 Park Ave., New York City, announces the acquisition of the GILMAN MFG. CO., East Boston, Mass., manufacturer of rock drilling equipment.

JEWELL ELECTRICAL INSTRUMENT CO., 1650 Walnut St., Chicago, Ill., has appointed B. F. Keith Co., Atlanta, Ga., representative of the company in Florida, Georgia, South Carolina, and northern Alabama.

DAVIS BORING TOOL CO., 6200 Maple St., St. Louis, Mo., manufacturer of expansion boring tools and reamers, has appointed H. E. Eaton & Co., 50 Church St., New York City, representative of the company.

DAVID LECKIE, 2231 Stewart St., Philadelphia, Pa., manufacturer of elevating die trucks, has appointed Haberkorn & Wood, 2208 W. Fort St., Detroit, Mich., exclusive agents for the company in the Detroit territory.

INDEPENDENT PNEUMATIC TOOL CO., 606 W. Jackson Blvd., Chicago, Ill., has appointed the Mine & Smelter Supply Co., Salt Lake City, Utah, as agent for the company, handling the complete line of Thor pneumatic tools.

CUTLER-HAMMER, INC., 1203 St. Paul Ave., Milwaukee, Wis., announces that the Philadelphia sales office of the company is now located on the tenth floor of the Terminal Commerce Building, 401 N. Broad St., Philadelphia, Pa.

FULLER LEHIGH CO., Fullerton, Pa., manufacturer of pulverized coal equipment, has removed its Cincinnati office from the Traction Building to Carew Tower, Cincinnati, Ohio. H. E. Martin will continue to be in charge as manager.

HOSKINS MFG. CO., 4439 Lawton Ave., Detroit, Mich., manufacturer of resistance wire, electric furnaces, and pyrometers, has appointed E. A. Wilcox California representative of the company. Mr. Wilcox is located at 273 Seventh St., San Francisco.

WELDED PRODUCTS CORPORATION, Kansas City, Mo., has purchased an eleven-acre industrial site on which, at a later date, a factory will be erected for the production of the company's spot welders. These are made in both the manually operated and automatic types.

BLACK & DECKER MFG. CO., Towson, Md., which took over the Domestic Electric Co. of Cleveland and Kent, Ohio, two years ago, announces that the name of the latter company has been changed to the BLACK & DECKER ELECTRIC CO. This branch of the company will continue to be located at Kent, Ohio.

BORDEN CO., Warren, Ohio, announces that the company has placed on the market a new Beaver 2 1/2- to 4-inch square-end pipe cutter. This is a gear-driven tool that incorporates the principle of self-feeding knives. When operated by power, the tool cuts off 4-inch pipe in approximately 2 1/2 minutes, and smaller sizes in proportion.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that a new manufacturing building, to cost about $1,000,000, will be erected at the Pittsfield plant of the company. The structure will be 550 feet long, 150 feet wide, and 70 feet high, and will be used for the manufacture of transformer tanks. The steel framework will be all arc-welded.

ACHESON GRAPHITE CORPORATION, Niagara Falls, N. Y., (a unit of the Union Carbide and Carbon Corporation) announces that beginning November 1 the entire line of Gredag lubricants manufactured by this concern will be distributed and sold by the Carbon Sales Division of the National Carbon Co., Inc., with headquarters at Cleveland, Ohio.

INTERNATIONAL NUTYP TOOL CORPORATION, Oswego, N. Y., announces that it has acquired the OSWEGO TOOL CO., manufacturer of wrenches, vises, pipe cutters, screw punches, and tube expanders. The officers of the new company are: H. W. Stone, president and general manager; E. B. Russell, vice-president and treasurer; and E. W. Fulton, vice-president and works manager.

EXACT LEVEL & TOOL MFG. CO., INC., High Bridge, N. J., manufacturer of wood and aluminum levels, machinists' levels and tools, rules and squares, is planning an addition to its plant consisting of a one-story concrete building to be ready in the early spring of 1931. The new building will be used as a machine shop and will materially increase the manufacturing capacity.

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., has awarded the contract for the design and construction of a new unit of the Continental Tool Division to the Austin Co., Cleveland, Ohio. The new plant which is necessitated by the need for increasing the company's manufacturing facilities, will be 53 by 190 feet, of one-story steel frame construction. It will be located at 5835 Martin Ave., Detroit.

GEARS & FORGINGS, INC., Cleveland, Ohio, announces that all its heavy gear and special machinery production will be concentrated at its Ford City, Pa., plant. The Ford City and the Pittsburgh plants have been merged, and the former plant will be engaged entirely in the manufacture of heavy gears, special machinery, steel mill equipment, strip coilers, sheet mill drives, and bridge operating equipment. The Pittsburgh branch office will remain at its old location, 2818 Smallman St.

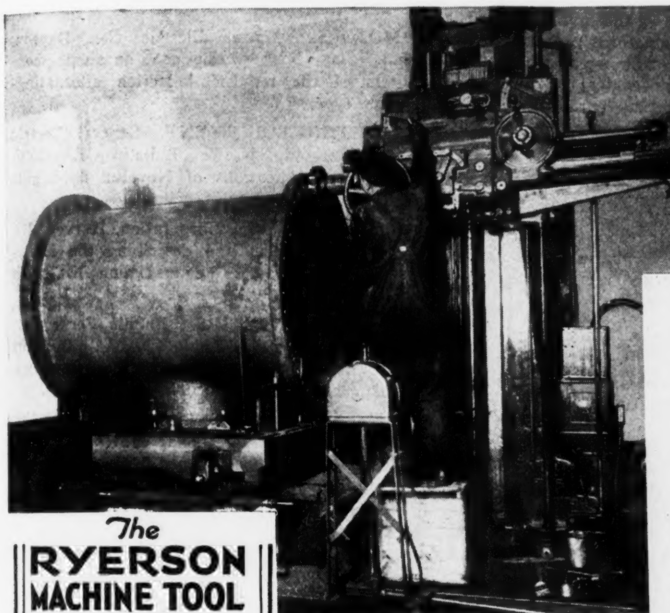
BLACK & DECKER MFG. CO., Towson, Md., announces the establishment of a division of the sales organization devoted to the marketing of high-cycle production tools, heavy-duty grinders, swing-frame grinders, snaggers, and buffers, under the trade name of Black & Decker-Van Dorn. This will group all the sales activities of the company, including its subsidiaries, under one head. Curtis C. Watts, formerly assistant advertising manager, has been placed in charge of this division, with the title of assistant sales manager.

MICROMATIC HONE CORPORATION has recently moved into its new plant at the corner of Horton and DuBois St., Detroit, Mich. With the steadily increasing demand for the micromatic cylinder hones made by this company, larger quarters have been found necessary, and an increase has also been made in the sales staff. Bennie Isom, formerly with the Hutto Engineering Co., will assist G. M. Calvert, head of the sales engineering staff, in the Detroit territory. G. J. Batzer will be in charge of the Cleveland territory, and O. W. Franke will have charge of the eastern territory.

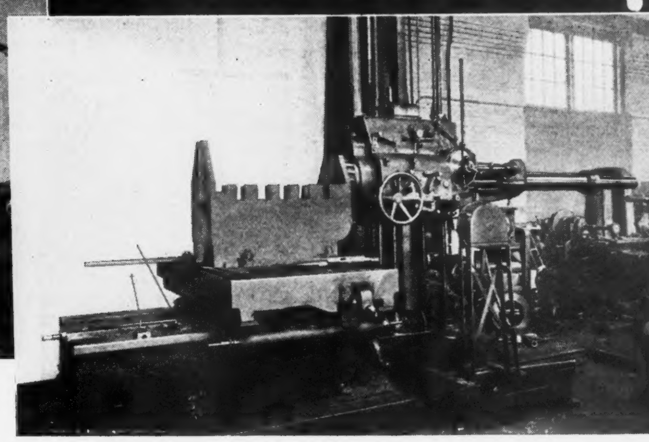
PALMER-BEE CO., Detroit, Mich., manufacturer of conveyors, speed reducers, flexible couplings, fabricated steel, coal and ash handling equipment, and power transmission equipment, announces the opening of the following district offices: Ellicott Square Bldg., Buffalo, N. Y., district manager C. E. Jeremias; Farmers Bank Bldg., Fifth Ave. and Wood St., Pittsburgh, Pa., district manager C. E. Musselman; Rockefeller Bldg., Cleveland, Ohio, district manager F. B. Barkwill; Reynolds Bldg., Winston-Salem, N. C., district manager E. S. Davidson; Bulletin Bldg., Philadelphia, Pa., district manager S. T. Transeau.

MCCROSKY TOOL CORPORATION, Meadville, Pa., has taken over the MIDWEST TOOL & MFG. CO., 2360 W. Jefferson Ave., Detroit, Mich., manufacturer of counterbores, core drills, inserted-blade cutters, and special cutting tools. The Midwest plant in Detroit will be operated as the Midwest Tool & Mfg. Co., Division of McCrosky Tool Corporation. The management of the former company has been retained. The home office of the McCrosky Tool Corporation will be maintained at Meadville, Pa., and will continue the manufacture of the standard McCrosky line of reamers, chucks, tapping equipment, and engine lathe attachments.

OHIO
HORIZONTAL BORING, DRILLING & MILLING MACHINES



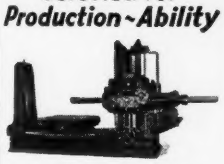
TIME SAVED on Both these Jobs!



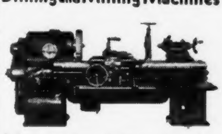
Ohio Floor Type Horizontal Boring, Drilling & Milling Machine Equipped With Compound Table

The
RYERSON MACHINE TOOL LINE

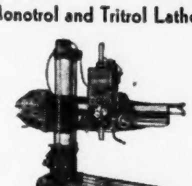
Built for Accuracy-Selected for Production-Ability



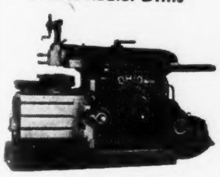
Ohio Horizontal Boring, Drilling and Milling Machines



Monotrol and Tritrol Lathes



Dreses Radial Drills



Ohio Shapers and Planers

RYERSON
Machinery Division
General Distributors
Machine Tools
Structural and Plate Working Equipment, Sheet Metal Tools—Welders, Railroad Shop Machinery, Small Tools, etc.

Time saved on both these jobs

Through simplification of set-up and combining of operations, this floor type Ohio Horizontal greatly reduced time on the jobs shown above. A 40% reduction in time was shown on facing and cutting the slots of the grinder pocket shown at the left. The 19,000 pound turbine condenser tee, shown at the right, was milled, drilled and backfaced with equal facility.

This machine, a floor type Ohio Horizontal, in the Green Bay Barker Machine & Tool Company plant at Green Bay, Wis., handles castings of all sizes, saving time and giving extreme accuracy. Other Ohio Machines are showing equally good records in other plants. Let us send you data on their production.

The exclusive features of the Ohio Horizontals which assure permanent accuracy and good production time on the finest work are described fully in Bulletin 4071. Write for a copy.

Ohio Horizontal Boring, Drilling and Milling Machines are built in all standard types and sizes:—the table type—planer table type—floor type—and combination floor and table type machines; meeting all requirements for high grade machine tools of this kind.

THE OHIO MACHINE TOOL COMPANY
KENTON, OHIO
General Distributors
JOSEPH T. RYERSON & SON, INC.
OFFICES IN CHICAGO AND OTHER PRINCIPAL CITIES

SOLD THROUGH EXCLUSIVE DEALERS

COMING EVENTS

NOVEMBER 12-14—Thirty-first annual convention of the International Acetylene Association at the Congress Hotel, Chicago, Ill. A. C. Morrison, secretary, 30 E. 42nd St., New York.

NOVEMBER 20—Meeting of the Electric Hoist Manufacturers' Association at the Hotel McAlpin, New York City. E. Donald Tolles, secretary-treasurer, 165 Broadway, New York City.

DECEMBER 1-6—Ninth National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

DECEMBER 1-6—Fifty-first annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

FEBRUARY 16-20, 1931—Second National Western Metal Congress and Exposition to be held in the Civic Auditorium, San Francisco, Calif., under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

APRIL 13-18, 1931—Second National Industrial Equipment Exposition at the Public Auditorium in Cleveland, Ohio. Managing director, G. E. Pfisterer, 308 W. Washington St., Chicago, Ill.

NEW BOOKS AND PUBLICATIONS

ACCIDENTS IN METAL STAMPING AND FORMING PLANTS. 60 pages, 6 by 9 inches. Published by the Department of Labor of the State of New York, Albany, N. Y.

MAKING THE PLANT SAFE. 16 pages, 5¼ by 7½ inches. Published by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, as Industrial Safety Pamphlet No. 9.

ENGINEERING AS A CAREER—A BULLETIN OF OCCUPATIONAL GUIDANCE. 16 pages, 6 by 9 inches. Published by Purdue University, Lafayette, Ind., as Bulletin No. 24 of the Engineering Extension Department.

AMERICAN NATIONAL STANDARD SCREW THREADS. 22 pages, 7½ by 10¾ inches. Published by the United States Department of Commerce, Washington, D. C., as Commercial Standard CS24-30 of the Bureau of Standards. Price, 10 cents.

ALLOYS OF IRON RESEARCH. 14 pages, 7 by 10 inches. Published by the Engineering Foundation, in cooperation with the American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York City, as Bulletin No. 4.

MECHANICAL CATALOGUE (1930-1931). 1104 pages, 8½ by 11¼ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twentieth edition of a work containing illustrated catalogue data of mechanical equipment, including power plant equipment; testing, measuring, and recording apparatus; power transmission machinery; conveying and hoisting machinery; metals, alloys, and other materials; foundry and rolling mill equipment; metal-working machinery, machine tools, and shop equipment; compressors, blowers, and pumps; heating and ventilating equipment and refrigerating machinery; general industrial equipment, and electric motors and control. The book also contains a directory of manufacturers of industrial equipment, materials, and supplies. The present edition of this work is the largest published to date, containing 780 products data pages, representing 574 firms. Over 4000 firms are listed in the directory.

TECHNO-DICTIONARY. English-German-Italian. By Hubert Hermanns. 411 pages, 4½ by 6 inches. Published by Hubert Hermanns, Dahlemer Strasse 64 A, Berlin-Lichterfelde (West), Germany. Price, $3.75.

This is the second edition of a handy technical dictionary that should prove of considerable value to manufacturers engaged in export trade and to readers of foreign engineering magazines. The new edition has been revised and enlarged, and contains a considerable number of terms not found in the first edition. The dictionary is arranged in three parts. The first part, with the German entry words alphabetically arranged, gives their equivalents in English and Italian. The second part contains the English entry words alphabetically arranged, with their equivalents in German and Italian. The third section contains the entry words in Italian, arranged alphabetically, with their equivalents in German and English. In this way, the dictionary will translate directly from any one of the three languages. The size of the book permits it to be carried conveniently in the pocket if so desired.

THE CONSTITUTION OF STEEL AND CAST IRON. By Frank T. Sisco. 332 pages, 6 by 9 inches; 105 illustrations. Published by the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio. Price, $3.

In an attempt to meet the demand for an elementary discussion of the theory underlying the constitution and heat-treatment of steel and cast iron, a series of twenty-four articles was prepared which appeared in the Transactions of the American Society for Steel Treating during the four-year period from 1926 to 1930. These articles are now published in book form. Each of the original articles is a chapter in the present book. In the writing of the chapters, a definite plan has been followed. Nearly every one begins with a brief summary of the previous discussion and ends with a summary of the points made in the chapter just concluded. No claim is made for originality; in fact, the author states in the preface that the subject matter is probably familiar to every theoretical metallurgist, but the presentation is simple and clear and intended for the practical man or engineer who has had no metallurgical training. Anyone wishing to obtain a general knowledge of the theory of the metallurgy of steel and cast iron should find this book of great value.

THE MECHANICS OF THE CALCULUS. By John Martin Barr. 358 pages, 8½ by 11 inches. Published by the Integraph Co., Caxton Building, Cleveland, Ohio. Price, $35.

This is not a book in the ordinary sense of the word. It is rather the exposition of a new method of making the methods of calculus more directly useful in engineering work than they have been in the past. The book is not printed from type, but from plates made from typewritten sheets, and includes a great many illustrations and charts illustrating both the mathematical principles involved and the use of auxiliary equipment furnished with the book in the form of three celluloid instruments, known as the "Integraph," the "Differentiator," and "Simpson's Rule." By the use of this auxiliary equipment, involved mathematical problems can be solved in a simpler way than would be possible by the direct use of the methods of calculus. The author states that the Integraph equipment bears much the same relation to the methods of calculus as the slide rule to multiplication or the planimeter to area determination.

The book itself is divided into three sections headed, respectively: "The Mechanics of the Calculus," "A Little About Mathematics," and "Preliminary to the Calculus of Mechanics." The first section deals with the manipulation of the mechanical equipment used in connection with the author's method. The section pertaining more strictly to mathematics is devoted largely to giving significance, by mechanical means, to the results of algebraic integration and differentiation. The third section deals with simple calculus problems, considers elastic structures, tractive effort and work, and velocity as the result of accelerative force.

NEW CATALOGUES AND CIRCULARS

MOTORS. Master Electric Co., Dayton, Ohio. Data book section 202, on single-phase motors of the repulsion-induction alternating-current type.

LIGHTING EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEA-161F, illustrating applications of Novalux floodlighting projectors.

CRANES. Whiting Corporation, Harvey, Ill. Circular illustrating and describing the Hi-Lo crane, which provides a maximum lift with minimum head room.

GAS UNIT HEATERS. Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. Bulletin 2754, illustrating and describing the company's gas unit heaters for industrial installations.

MILLING CUTTERS. Brown & Sharpe Mfg. Co., Providence, R. I. Circular entitled "Beyond Purchase Price—Performance!" outlining the advantages of Brown & Sharpe milling cutters.

RECORDING AND CONTROLLING EQUIPMENT. Bristol Co., Waterbury, Conn. Catalogue 4000, containing data on Bristol's air-operated control equipment, including operating information.

BENCH PROFILING MACHINES AND LATHES. Wade Tool Co., Waltham, Mass. Bulletin illustrating and describing motor-driven bench profiling machines and screw-chasing bench lathes.

BALANCING MACHINES. Gisholt Machine Co., Madison, Wis. Service bulletin 48, illustrating and describing the use of Gisholt static balancing machines in the manufacture of airplane propellers.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin 1-A, "Society of Automotive Engineers' Standard Specifications for Steels." Bulletin 17, "Nickel Alloy Steel Forgings."

WELDING EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEC-93, describing the characteristics of G-E welding electrodes and the classes of work for which the various types are adapted.

TURRET LATHES. Gisholt Machine Co., Madison, Wis. Service bulletins 49 to 51, inclusive, illustrating various jobs performed on Gisholt high-production turret lathes. Complete production data is given in each case.

STEEL CASTINGS. Sivyer Steel Casting Co., 37th Ave. and Mitchell St., Milwaukee, Wis. Circular outlining the advantages of electric steel castings and listing the properties of a new alloy steel known as "Miraculoy."

MOTORS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet L-20503, describing the construction and operation of Types AD and ADS motors for use in vacuum cleaners, fans, and portable electric tools.

SHEARS. Henry Pels & Co., Inc., 90 West St., New York City. Catalogue FV-1930, descriptive of Pels big billet shears with steel plate frame. A table of capacities and specifications of the various sizes is included.

STEEL. Firth-Sterling Steel Co., McKeesport, Pa. Booklet descriptive of the characteristics of Circle C Blue Chip high-speed steel, including a record of actual performances obtained with this steel in customers' plants.

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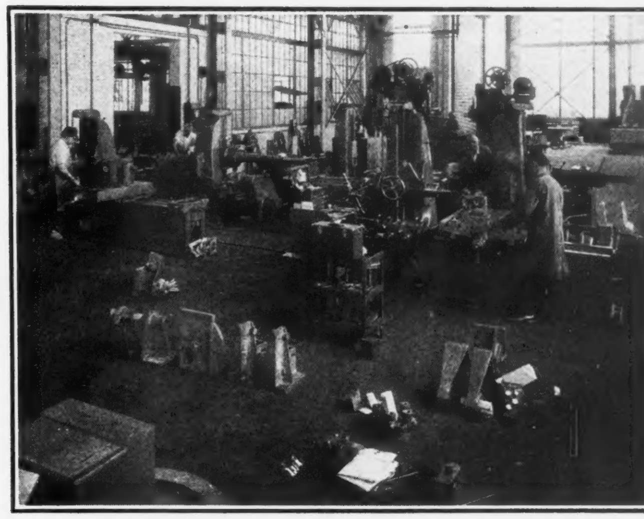

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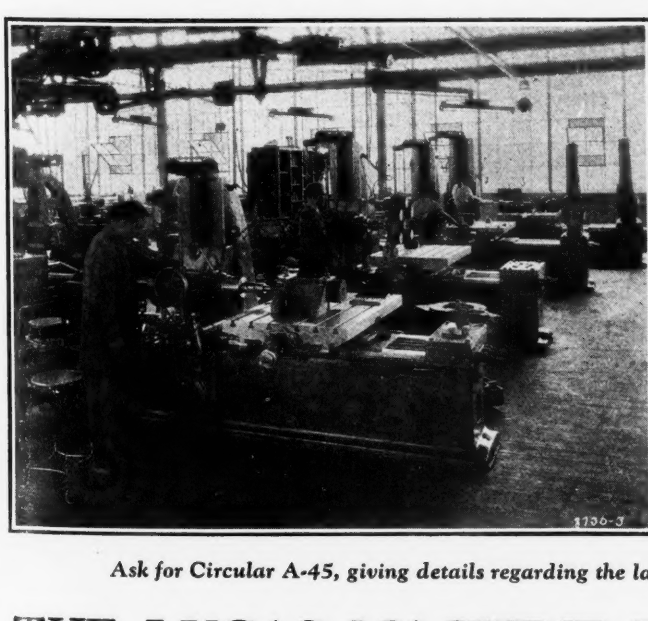

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CONVEYORS. Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. Folder 1248, descriptive of "Cub" portable belt conveyors. Illustrations of these machines at work under many conditions are shown, and specifications are given.

MATERIAL - HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular describing the construction of the Cleveland tramrail carriers, and showing applications on various classes of work.

PIPE THREADING AND CUTTING MACHINES. Landis Machine Co., Inc., Waynesboro, Pa. Bulletin C-61, illustrating and describing the Landis 6-inch and 8-inch pipe threading and cutting machines. Complete specifications of the two sizes are included.

COUNTERBORES AND SPOT - FACERS. National Tool Co., Madison Ave., at W. 112th St., Cleveland, Ohio. Bulletin containing a complete list of the dimensions and prices of National-Cleveland Style B double key drive interchangeable counterbores and spot-facers.

TOOLS AND AUXILIARY MACHINE EQUIPMENT. Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn. Catalogue 23, giving dimensions and price lists of ball-bearing and high-speed centers; lathe, planer, threading, and boring tool holders; and grinder dogs.

ELECTRIC HOISTS. American Engineering Co., 2435 Aramingo Ave., Philadelphia, Pa. Catalogue illustrating and describing the Lo-Hed line of electric hoists. A list of representative installations of these hoists is given, and applications on many different classes of work are illustrated.

SMALL TOOLS. Goodell-Pratt Co., Greenfield, Mass. General catalogue 17, containing 416 pages, illustrating the line of tools made by this concern, including screwdrivers, automatic drills, micrometers, hacksaw frames, woodworking lathes, cold chisels, punches, electric drills, etc.

CHUCKS. Skinner Chuck Co., New Britain, Conn. Catalogue 43-A, illustrating the Skinner line of air chucks, and giving specifications for the various styles. The savings in production costs made possible by the use of air-operated chucks are pointed out, and actual air chuck installations are shown.

VANADIUM STEEL. Vanadium Corporation of America, 120 Broadway, New York City. Reprint of an article from *Steel* entitled "Vanadium Additions Improve Steel," by N. Petinot, treating of the development of vanadium-containing steels, their properties, and applications in major industries.

POWER TRANSMISSION EQUIPMENT. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Drive data book No. 78, listing Diamond stock chain drives for application to motors ranging from 1/4 to 75 horsepower, in ratios up to 8.4 to 1, and for motor speeds up to 1800 revolutions per minute.

SURFACE GRINDERS. Blanchard Machine Co., 64 State St., Cambridge, Mass. Catalogue 67, describing the construction and operation of Blanchard No. 16 high-power surface grinders. Various examples of the class of work done on these machines are shown, and complete production data are given in each case.

ALUMINUM DIE-CASTINGS. Aluminum Company of America, 2437 Oliver Bldg., Pittsburgh, Pa. Pamphlet illustrating various examples of aluminum die-castings. Information is given concerning Alcoa aluminum alloys, including the properties, advantages, applications, etc., and points on die-casting design are also included.

RUBBER BELTING, HOSE, AND PACKING. Diamond Rubber Co., Inc., Akron, Ohio. Catalogue of belting, packing, hose, matting, and miscellaneous items for industrial use. Attention is called to the fact that the cover of the catalogue was printed from rubber engravings hand-cut from sheet rubber manufactured by the Diamond Rubber Co.

DIE-HEADS. Landis Machine Co., Inc., Waynesboro, Pa. Bulletin F-71, descriptive of the salient features of Landmatic die-heads for turret lathes and screw machines. Complete specifications are included. Bulletin F-72, descriptive of Landex die-heads for automatic screw machines and other machines employing a rotary pull-off type of head.

MILLING CUTTERS. Lovejoy Tool Co., Inc., Springfield, Vt. Catalogue entitled "Meeting Milling Cutter Requirements," showing the complete Lovejoy line of standard and special multiple-cutter tools. The catalogue shows tools especially adapted for holding tungsten-carbide blades, as well as special counterboring tools. A grinding angle chart is included.

HEAT-TREATING FURNACES. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 930, illustrating and describing pot type electric furnaces for heat-treating purposes. Bulletin 1030 on the new vertical pressure carburizing furnace made by this company. Leaflet on the Hevi Duty automatic excess temperature cut-out, which is applicable to any type of furnace.

SHOP TRUCKS. Lewis-Shepard Co., Watertown Station, Boston, Mass. Catalogue of the company's complete line of standard and special floor trucks, in the construction of which arc welding has been used wherever practicable. The catalogue illustrates and describes almost every type of hand-operated shop floor truck, as well as hand- and power-operated stackers.

SPEED REDUCERS. Falk Corporation, Milwaukee, Wis. Bulletin 230, illustrating and describing Falk parallel-shaft speed reducers. This bulletin covers 68 pages, 8 1/2 by 11 inches, printed in two colors, and gives complete description, operating instructions, and specifications of speed reducers and flexible couplings. A great number of actual installations are illustrated.

LABORATORY EQUIPMENT. Diamant Tool & Mfg. Co., Inc., 401 Mulberry St., Newark, N. J. Circular illustrating and describing the Travis laboratory colloid mill for mechanical dispersion or separation into microscopic particles, and for the emulsification or suspension of finely divided matter in a liquid medium, as well as for the intimate mixing of similar parts to a uniform mass.

WELDING ELECTRODES. Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Circular describing Weldite green surfaced welding rods for the metallic arc welding of mild steel. The bulletin describes, in detail, the effect of green surfacing on the welding arc as well as the operating characteristics of the electrode, and explains why the action of green surfacing reduces welding costs.

TOOL GRINDERS. William Sellers & Co., Inc., Philadelphia, Pa. Bulletin entitled "The Use of Tungsten Carbide as a Cutting Material on Heavy Machine Tools," containing a reprint of an article published in *Mechanical Engineering*. The last few pages of the circular show the Sellers tool grinders, which are suitable for grinding tungsten-carbide tools, as well as all other tools, and outline the advantages of machine grinding.

PLATING MACHINES. Meaker Co., Chicago, Ill. Bulletin entitled "Full Automatic Straight-A-Way and Return Type Plating Machines," containing information on the advantages to be derived from the use of full automatic machinery for plating, galvanizing, pickling, cleaning, and finishing. Specific equipment is illustrated and described. One chapter of particular interest is devoted to chromium plating with full automatic machines.

GEARS. Fellows Gear Shaper Co., 78 River St., Springfield, Vt. Fifth edition of a bulletin entitled "The Involute Gear," comprising a concise treatise on the action of involute gearing. The text is divided into four chapters dealing with the following subjects: Function of gearing and application of the involute curve; gear tooth shapes and advantages of involute gears; generating involute gear teeth; definitions and proportions of gear tooth elements.

DIE-CASTINGS. Allied Die Casting Corporation, Long Island City, N. Y., is publishing a house organ entitled "The Allied Die Caster." This publication is written for all those interested in the production economies made possible by the die-casting process. A series of articles is being run on the application of the die-casting art in modern industry. Copies of the publication will be sent regularly to executives who request them on their business letterheads.

ROLLER CHAIN. Union Chain & Mfg. Co., Sandusky, Ohio. General catalogue containing 124 pages on silent and roller chain. The catalogue contains complete data on these types of chain, as well as engineering data of value in figuring chain drives. It also contains information and engineering data on sprockets used in conjunction with silent and roller chain drives, and on chain attachments for special purposes. A copy of the catalogue will be sent to those interested upon request.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Pamphlets GEA-38B, 1089A, 1152A, 1172A, 1210, 1277, 1303A, and 1318, illustrating and describing, respectively, direct-current crane and hoist motors; automatic telemetering equipment; synchronous motors for pumping; super-synchronous motors for large grinding and pulverizing mills; electric equipment for cranes; fractional-horsepower motors and motor parts; squirrel-cage induction motors; and quartz-rod thermostat for use with metal-melting pots.

INDICATING AND CONTROLLING INSTRUMENTS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Booklet entitled "The Era of Automatic Control," illustrating a wide variety of applications of Brown instruments for controlling temperatures in heat-treating and other processes, as well as for controlling pressures, flows, liquid levels, etc. General catalogue 15A, containing 104 pages covering Brown indicating, recording, and automatic control pyrometers for measuring temperatures to 3000 degrees F.

HEAT-TREATING EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEB-83, containing a detailed description of the heat-treatment of steel in G-E standard electric furnaces. The pamphlet describes the hardening, annealing, normalizing, casehardening and tempering or drawing processes, and tells how electric heat-treatment affects production costs. The third section of the book is devoted to the construction and maintenance of G-E electric furnaces, and the final section illustrates and describes the different types.

INSTRUMENT FOR STUDYING HIGH-SPEED MOTION. Livingstone & Southard, Inc., Whitehall Bldg., 17 Battery Place, New York City. Catalogue describing the construction and application of the Ashdown Rotoscope, a machine for making a slow-motion study of rapidly moving objects, made by A. J. Ashdown, Ltd., of London, England. This machine not only makes it possible to study fast-moving objects at a slow speed, but also enables the speed to be determined accurately within a range of from 150 to 50,000 revolutions per minute, and any deviation or inconsistency in speeds between objects supposed to be running synchronously can be detected up to 0.01 per cent.